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CX20671

Low-Power Codec SoC with Integrated Class-D Stereo Amplifier for High Definition Audio

Data Sheet

Revision History

Revision	Date	Description
A	February 19, 2010	Initial release
B	March 11, 2010	Revision B release
C	March 29, 2010	Revision C release
D	May 25, 2010	Revision D release *Changed all occurrences of Ns to ns (representing nanoseconds) in Tables 17-19 . *Removed "Audio only" from Table 21 . *Added SPDIF Out feature. *Added new bullet to the list on page 32, Section 2.5.1 . *Changed EPSS-supported items in Sections 3.2.2- 3.2.14 from green to bold-type .
E	May 27, 2010	Revision E release *Added further information to the second-to-the-last bullet (DVDD_3.3) on page 32.
p1	July 22, 2010	Preliminary p1 release *Updated to include information on -21Z devices.

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Introduction

1.1 Overview

Conexant's CX20671 HD Audio codec SoC is a low-power, 102 dB SNR, high-performance audio codec with integrated 2-WRMS (per channel) stereo speaker amplifier with Spread Spectrum EMI dispersion technology. Two independent pairs of DACs and three independent pairs of ADCs support Multi-Streaming and Real Time Communications applications. The audio fidelity of the device exceeds Microsoft WLP 4.0 Desktop and Notebook Premium Logo requirements. Additionally, the device achieves a high level of integration by featuring an integrated 5 V to 3.3 V Low-dropout (LDO) voltage regulator that guarantees high performance analog audio performance without incurring external BOM, and an integrated 3.3 V to 1.8 V low-dropout voltage regulator used to power internal digital blocks.

The device features a ProCoustic capless headphone driver. This high-output power headphone driver delivers 50 mW per channel into a 32 Ω load, eliminating the need for an external headphone amplifier and DC-blocking capacitors, and produces a full range frequency response without sacrificing the output level. The ProCoustic headphone driver provides a true high-definition listening experience from the PC for the audio aficionado. All output ports feature PopShield circuitry that eliminates pops or clicks.

The CX20671 also features Conexant's D-Flex power management scheme, which allows the system to exceed the power savings specified in the Intel ECR 15B requirement. The entire audio SOC consumes 16.79 mW during S0-idle. The internal Wake-on-PC-Beep logic resumes the analog paths for the external PC-Beep to propagate through to the output ports.

The CX20671 features one single-bit stream digital microphone interface, which allows interfacing to two digital microphones for dual microphone array implementations. The Digital Microphone Interface (DMI) is optimized with a hardware DC-level filter, which compensates for digital microphones with DC offset limitations. Conexant has qualified many digital microphones and listed them on the Approved Vendor List (AVL), providing the OEM and the ODM with more selections and flexibility. The audio codec features an independent SPDIF out supporting sample rates up to 96 kHz, 16-24-bit resolution.

The device is compliant with Intel's High Definition Audio Specification (Revision 1.0), as well as the ECR 15B power management scheme.

Conexant offers the most comprehensive software options:

- ◆ In-house developed Voice Processing Algorithms enhances the clarity of VoIP calls and improves the accuracy of voice commands and dictation.
- ◆ SoftEQ with Dynamic Range Compression improves the sound quality of low cost speakers.
- ◆ 3D Expander widens the audio stage for fuller and richer sound.
- ◆ Audio Director augments multi-streaming capability; and third-party end point redirection/switching (i.e., HDMI and Bluetooth). Third party software APO support includes SRS, Dolby, Creative Labs, and others.

Table 1 shows the different devices and the functions that are supported for each. Figure 1 illustrates the CX20671 devices and major signal interfaces.

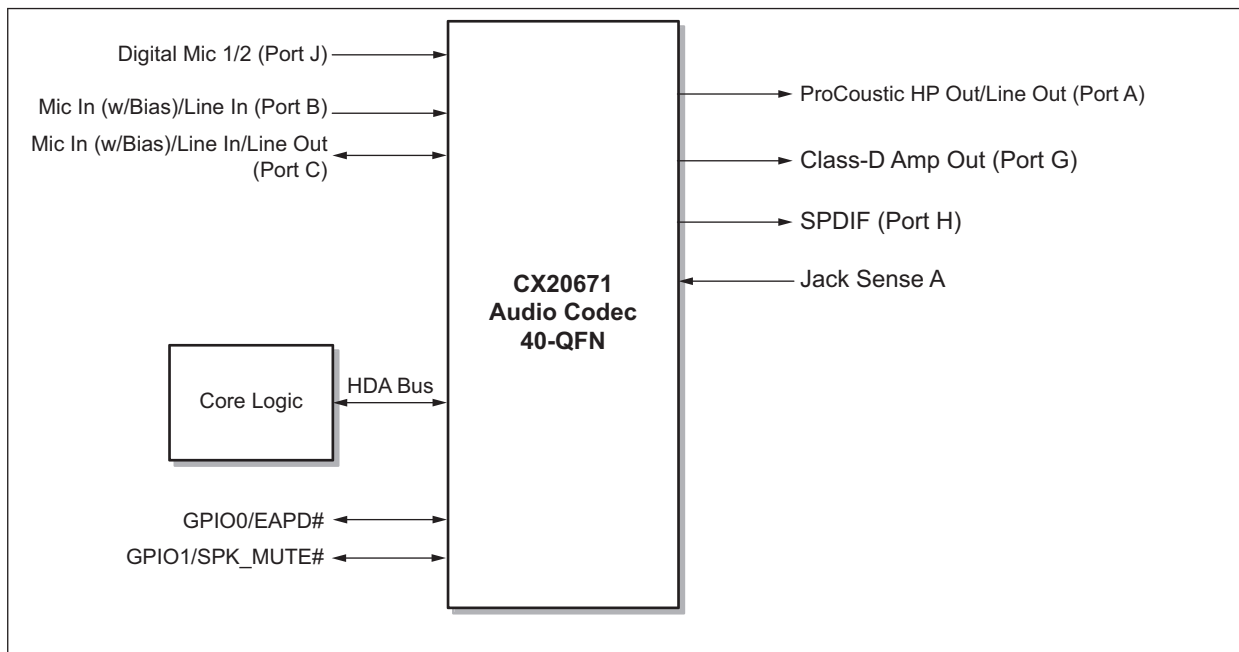
Table 1. CX20671 Models and Functions

Model/Order/Part Numbers						Supported Functions	
Device Set Order Number	Audio Codec Part Number	Codec Revision	Audio Codec Package Type	SmartDAA4 Line Side Device (LSD) [16-Pin QFN] Part Number	V.92 Modem	Number of DACs/ADCs	Digital Mic
CX20671-11Z	CX20671	-11Z	40-QFN	None	N	4/6	2
CX20671-21Z	CX20671	-21Z	40-QFN	None	N	4/6	2

GENERAL NOTES:

1. Supported functions (Y = Supported; N = Not supported).
2. All devices are lead-free (Pb-free) and RoHS-compliant, and are compatible with leaded reflow processes.
3. Contact local Conexant Sales office for advanced software options.

Figure 1. CX20671 Devices and Major Signal Interfaces



1.2 CX20671 Audio Codec Features

- ◆ 24-bit, two pairs of independent DACs and three pairs of independent ADCs
- ◆ ProCoustic headphone driver, which delivers 50 mW into 32 Ω load with no pop, eliminating the need for an external amplifier and DC-blocking capacitors
- ◆ Integrated 5 V to 3.3 V low-dropout voltage regulator for improved audio performance, eliminating need for external regulator or power transistor
- ◆ Integrated 3.3 V to 1.8 V low-dropout voltage regulator, used to power digital blocks
- ◆ Integrated 2 WRMS (per channel) class-D stereo speaker amplifier with Spread Spectrum and 10-kV ESD withstand capability
- ◆ Digital Microphone interface with internal MIC boost supporting 2 digital microphone elements
- ◆ Independent Sony Philips Digital Interface (SPDIF) Output supporting sample rates 44.1 kHz, 48 kHz, and 96 kHz, 16, 20, and 24-bit resolution
- ◆ Internal microphone boost
 - Digital: 0, 12, 24, 36, 48 dB
 - Analog: 0, 10, 20, 30, 40 dB
- ◆ Microphone Security Control (Contact Conexant Sales/FAE for additional information).
- ◆ Exceeds Vista/Windows 7 Desktop and Notebook Premium Logo Requirements, WLP4.0
- ◆ D-Flex power management exceeds Intel ECR 15B requirements, and features Wake-On-PCBeep functionality
- ◆ Hardware Headphone limiter bit (supports GS Mark EN50332-2)
- ◆ Compliant with Intel High Definition Audio Specification Rev. 1.0
- ◆ Supports both 1.5 V and 3.3 V signaling with the core logic chipset
- ◆ Retaskable ports
 - Configure between Headphone and Line-out or between Mic and Line-in
- ◆ Independent sampling rate for DAC and ADC; supports audio formats ranging from 16-bit, 44.1 kHz to 24-bit, 192 kHz
- ◆ Pop Shield: pops and clicks reduction circuitry, including class-D speaker outputs
- ◆ Jack sense detects up to four jacks using only one sense pin
- ◆ Digital Mixer
- ◆ +3.3 V analog and I/O operation; uses Vaux for power management modes
- ◆ Audio Director for Headphone and Internal Speakers Redirection (optional).
 - Supporting Classic Mode
 - Vista/Windows 7 Multi-Stream
 - Custom Multi-Stream Mode
- ◆ Voice Processing Algorithms (optional)

- End-to-end Noise Reduction (patent pending)
- Multi-band Acoustic Echo Cancellation
- Side Noise Rejection Beam Forming
- ◆ SmartAudio GUI (optional) - advanced audio control
- ◆ Digital Parametric SmartEQ with Dynamic Compression DSP (optional)
 - Enhances the sound quality on low cost speakers
 - Night Mode
- ◆ 3D Expander
- ◆ Third Party Logo Software support includes
 - SRS
 - Dolby
 - Creative Labs
 - ForteMedia
 - Andrea
 - MaaxAudio
 - Virage Logic
- ◆ Supports 32-bit/64-bit Windows OS and Linux
- ◆ Available in 40-pad thermally-enhanced QFN package

1.3 System Compatibility

- ◆ System compatibility
 - Windows XP/Vista/Windows 7 operating system on a 1 GHz-based computer with 512 MB RAM, or equivalent
 - Microsoft Vista/Windows 7 Premium Logo compliant, WLP4.0
 - Linux Kernel (contact local Conexant Sales Office for details)

1.4 Hardware Qualification Process

The Hardware Qualification Process (HQP) is intended to improve the quality and reliability of ODM custom boards being shipped to PC OEMs. The goals of this process are to:

- ◆ Eliminate common design mistakes
- ◆ Ensure boards perform well and pass DTM Fidelity requirements with good margin
- ◆ Eliminate potential manufacturing issues that may result from a marginal design
- ◆ Eliminate country specific issues
- ◆ Eliminate common INF problems
- ◆ Converge towards standard designs

The HQP includes review of schematics, board layout, and BOM (Bill of Material). All boards must meet the pre-defined criteria. Contact the local Conexant Sales office for more details about the HQP process.

HQP *must* be performed for all OEM designs.

Hardware Interface

2.1 General

2.1.1 HD Audio Host Interface

The HD Audio host interface conforms to HD Audio (Rev. 1.0)

The supported HD Audio signals are as follows:

- ◆ Bit Clock (BIT_CLK), input
- ◆ Frame Sync (SYNC), input
- ◆ Serial Data Output (SDATA_OUT), input
- ◆ Serial Data Input (SDATA_IN), input/output
- ◆ Master Hardware Reset (RESET#), input

2.1.2 Control Signals

Control signals supported from straps or the host are as follows:

- ◆ External Amplifier Power Down (EAPD#), output
- ◆ Class-D speaker mute (SPK_MUTE#), input
- ◆ Jack sensing (SENSEA), input
- ◆ General-purpose inputs/outputs (GPIO0, GPIO1)

2.1.3 Audio Signals

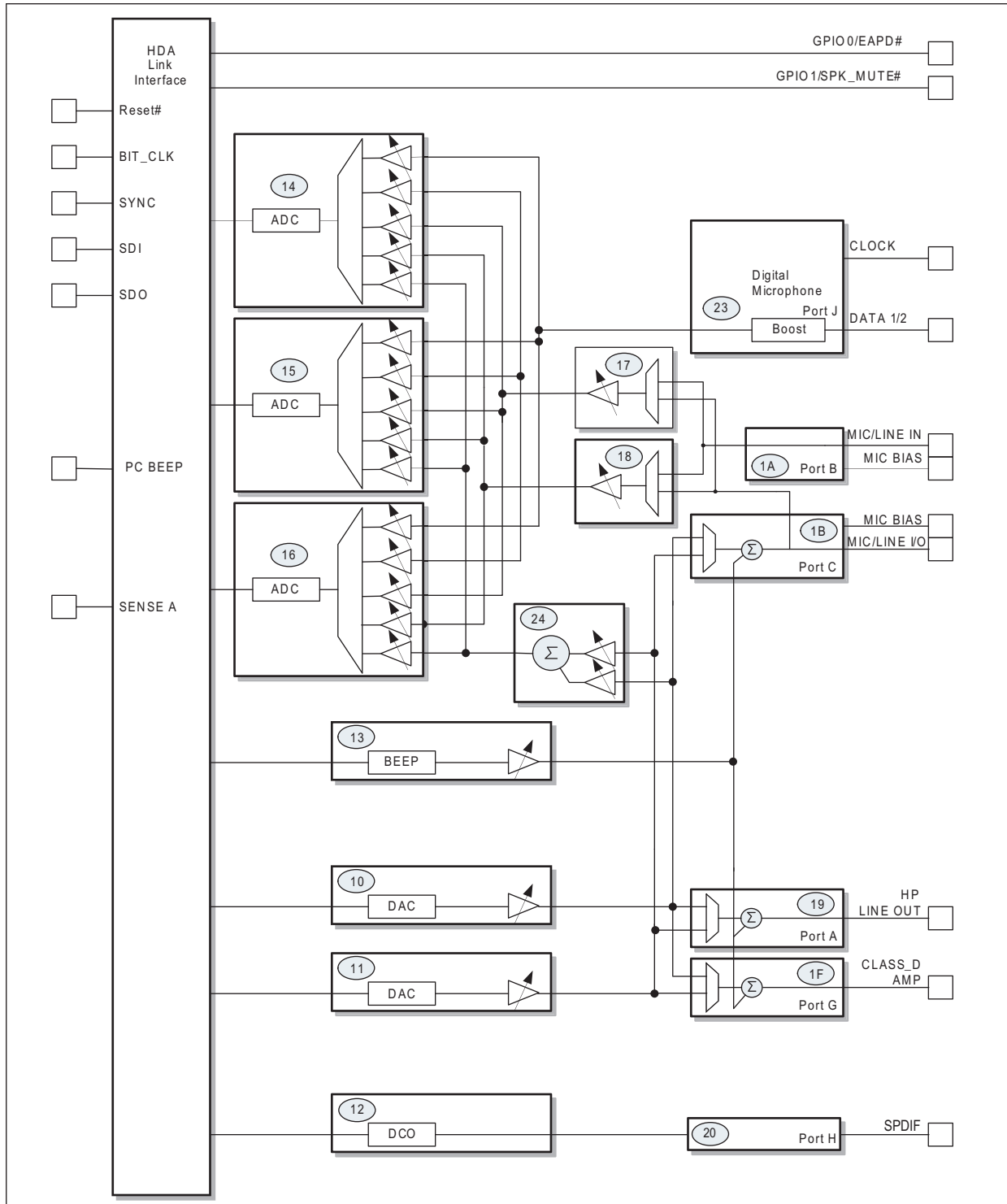
Audio interface signals supported are as follows:

- ◆ Port A (PORTA_L and PORTA_R), ProCoustic headphone output/line output
- ◆ Port B (PORTB_L and PORTB_R), microphone input/line input, with microphone bias voltage
- ◆ Port C (PORTC_L and PORTC_R), microphone input/line input/line output, with microphone bias voltage
- ◆ Port G (LEFT_± and RIGHT_±), Class-D speaker amplifier stereo output
- ◆ Digital Stereo Microphone (DIGITAL_MIC_1/2), digital microphone input, dual array
- ◆ PC Speaker Beep pass-through (PC_BEEP), input
- ◆ Sony Philips Digital Interface (SPDIF) Output

2.2 CX20671 Block Diagram

Figure 2 provides a simplified block diagram of the CX20671.

Figure 2. CX20671 Block Diagram



2.3 CX20671 Pin Assignments, Signal Definitions, and Electrical Characteristics

The CX20671 40-QFN device signals are shown by major interface in [Figure 3](#), by pin number in [Figure 4](#), and are listed by pin number in [Table 2](#).

Hardware interface signals are defined in [Table 3](#).

Figure 3. CX20671 40-QFN Hardware Interface Signals

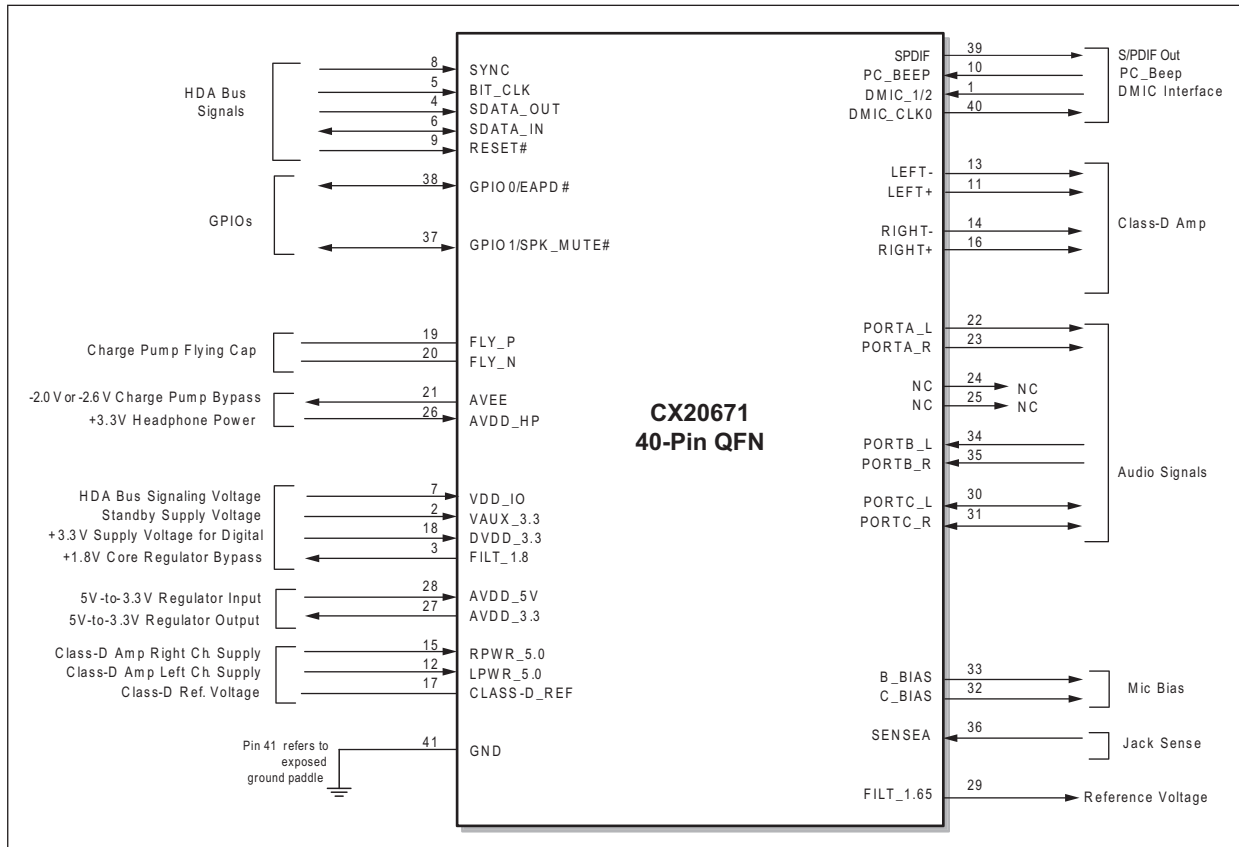


Figure 4. CX20671 40-QFN Pad Signals

Pin Define

Please help add Pin41 GND for Thermal Pad

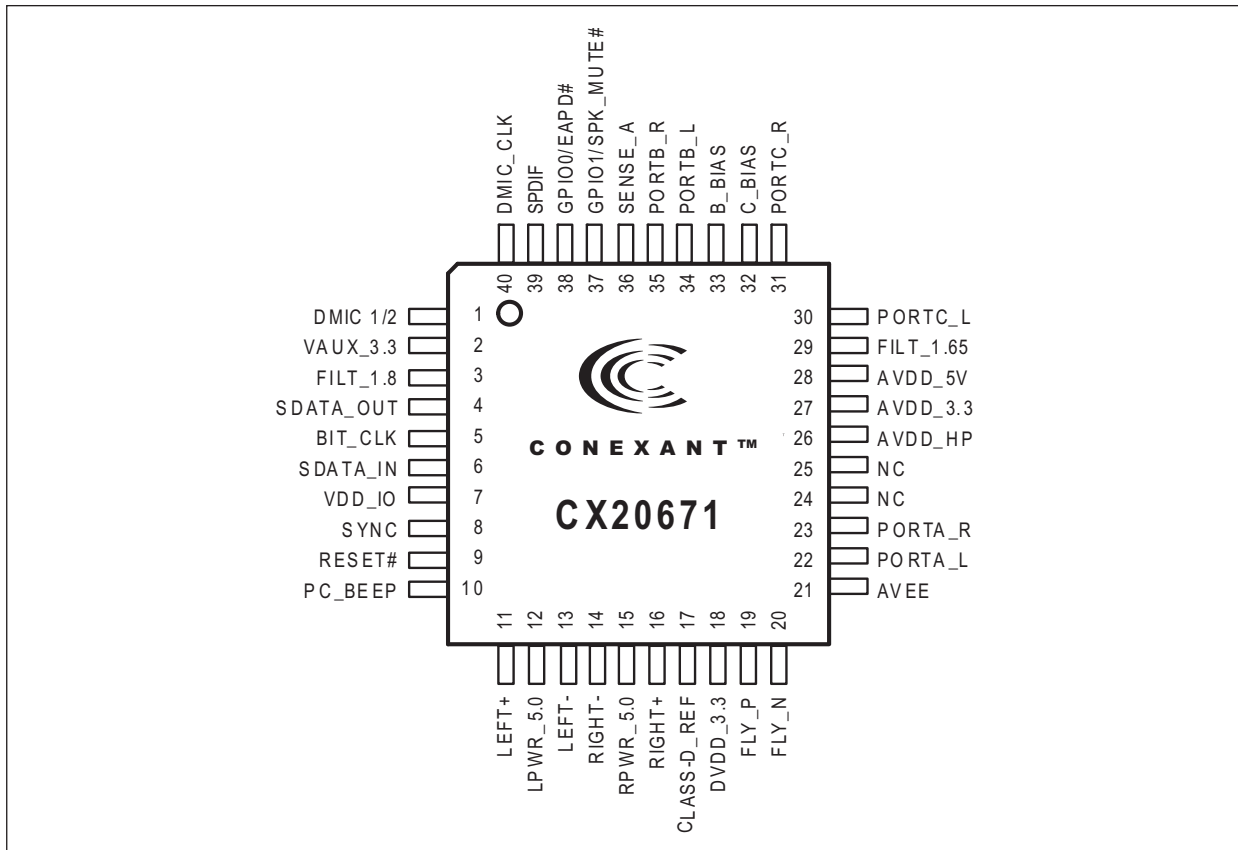


Table 2. CX20671 Pad Signals

Pad Number	Signal Name	Pad Number	Signal Name
1	DMIC_1/2	21	AVEE
2	VAUX_3.3	22	PORTA_L
3	FILT_1.8	23	PORTA_R
4	SDATA_OUT	24	NC
5	BIT_CLK	25	NC
6	SDATA_IN	26	AVDD_HP
7	VDD_IO	27	AVDD_3.3
8	SYNC	28	AVDD_5V
9	RESET#	29	FILT_1.65
10	PC_BEEP	30	PORTC_L
11	LEFT+	31	PORTC_R
12	LPWR_5.0	32	C_BIAS
13	LEFT-	33	B_BIAS
14	RIGHT-	34	PORTB_L
15	RPWR_5.0	35	PORTB_R
16	RIGHT+	36	SENSE_A
17	CLASS-D_REF	37	GPIO1/SPK_MUTE#
18	DVDD_3.3	38	GPIO0/EAPD#
19	FLY_P	39	SPDIF
20	FLY_N	40	DMIC_CLK
		41 ⁽¹⁾	GND (Note 1)

FOOTNOTES:

⁽¹⁾ Pad 41 refers to the exposed pad at the bottom of the device. This thermal/electrical pad must be connected to PCB ground plane with enough vias. It is recommended that a 4x4 grid of such vias be used.

Table 3. CX20671 Pad Signal Definitions (1 of 4)

Label	Pad Number	Type	I/O Type	Signal Name/Description
Power				
DVDD_3.3	18	PWR	PWR	Digital Supply Voltage. +3.3 V. Connect to system +3.3 V.
VAUX_3.3	2	PWR	PWR	Standby Supply Voltage. +3.3 V. Connect to system's +3.3 V Standby supply. This power pin is used to support Wake-on-Jack functions.
VDD_IO	7	PWR	PWR	Input/Output Signaling Voltage Supply. Determines the signaling voltage that is being used on the host system. When VDD_IO is +1.5 V, the device will use 1.5 V signaling on the HDA interface pins; when VDD_IO is +3.3 V, the device will use 3.3 V signaling on the HDA interface pins.
FILT_1.8	3	PWR	PWR	Internally Regulated Digital Core Supply Voltage. +1.8 V \pm 5%. Connect to external decoupling capacitor.
AVDD_5V	28	PWR	PWR	Analog Supply Input Voltage for LDO. +5.0 V. Connect to system +5.0 V supply.
AVDD_3.3	27	PWR	PWR	Output Voltage from LDO. +3.3 V \pm 5%. Connect to external decoupling capacitor.
AVDD_HP	26	PWR	PWR	Supply Input Voltage for Headphone Amplifiers. +3.3 V. Connect to system +3.3 V.
RPWR_5.0	15	PWR	PWR	Supply Voltage for Class-D Amplifier, Right Channel. +5.0 V. Connect to LPWR_5.0. Connect LPWR_5.0/RPWR_5.0 to system +5.0 V supply through a 0.1 Ω resistor.
LPWR_5.0	12	PWR	PWR	Supply Voltage for Class-D Amplifier, Left Channel. +5.0 V. Connect to RPWR_5.0. Connect LPWR_5.0/RPWR_5.0 to system +5.0 V supply through a 0.1 Ω resistor.
FLY_N	20	PWR	PWR	Charge Pump Negative Transfer Charge. Connected to FLY_P through a 2.2 μ F or 1.0 μ F capacitor.
FLY_P	19	PWR	PWR	Charge Pump Positive Transfer Charge. Connected to FLY_N through a 2.2 μ F or 1.0 μ F capacitor.
AVEE	21	PWR	PWR	Internally Generated Analog Negative Supply. Connect to external decoupling capacitor. -2.6 V when HP output set at 1.2 Vrms \pm 10% -2.0 V when HP output set at 1.0 Vrms \pm 10%

Table 3. CX20671 Pad Signal Definitions (2 of 4)

Label	Pad Number	Type	I/O Type	Signal Name/Description
Ground				
GND	41	GND	GND	Audio Device Ground. This is thermal/electrical GND paddle of device. Connect to audio_ground.
High Definition Audio Interface				
BIT_CLK	5	I	Ihd	Bit Clock. 24 MHz serial data input bit clock from the HDA link. Connect to BITCLK.
SYNC	8	I	Ihd	Frame Sync. 48 kHz fixed rate sample HDA sync input. Synchronization pulse from an HDA compliant controller to all of the HDA compliant codecs on the link. This signal is nominally 0.167 μ s wide pulse that is used to synchronize the HDA. Reset state = low. Standard load = 50 pF. SYNC is derived from dividing BITCLK by 500. Connect to SYNC.
SDATA_OUT	4	I	Ihd	Serial Data Output. Serial input data stream from an HDA controller. Reset state = low. Standard load = 50 pF. Connect to SDATA_OUT through 33 Ω
SDATA_IN	6	I/O	Ohd	Serial Data Input. Serial output data stream to the HDA controller. Functions as an input during codec initialization. Controller has a weak pull-down resistor to prevent spurious events in electrically noisy environments. Connect to SDATA_IN through 33 Ω
RESET#	9	I	Ihdl	Master Hardware Reset. Active low HDA link reset signal. The minimum width of this pulse must be 100 μ s. Connect directly to RESET.
Reference Voltage Connections				
FILT_1.65	29	REF	REF	Analog Reference Voltage. 1.65 V \pm 5%. Connect to external decoupling capacitor.
CLASS-D_REF	17	REF	REF	Class-D Amplifier Reference Voltage. Connect to RPWR_5.0/LPWR_5.0 voltage supply through external capacitor.

Table 3. CX20671 Pad Signal Definitions (3 of 4)

Label	Pad Number	Type	I/O Type	Signal Name/Description
General Purpose Input/Outputs				
GPIO0/EAPD#	38	I/O	It/Ot	External Amplifier Power-Down Signal/ General Purpose I/O. EAPD# is an active-low output. If EAPD = 0, power down the external amplifier. If EAPD = 1, power up the external amplifier
GPIO1/SPK_MUTE#	37	I/O	It/Ot	General Purpose I/O, Class-D Speaker Amplifier Mute Input. SPK_MUTE# is a active-low input.
Audio Digital Signals				
PC_BEEP	10	I	Id	PC Speaker Beep Pass-Through. Input. Logic-level BEEP signal needs to be ac-coupled to this pin.
DMIC_1/2	1	I	Id	Stereo Digital Microphone Data. Input
DMIC_CLK	40	O	Od	Digital Microphone Clock. Output
SPDIF	39	O	It/Ot	Sony Philips Digital Interface (SPDIF) output. Note: For -21Z devices only, a pull-down on this pin sets PC BEEP gain to -18 dB while the codec is in RESET.
Audio Analog Signals				
These signals connect to analog sources and sinks, including microphones and speakers.				
PORTB_L	34	I	Ia	Microphone Input/Line Input, Left Channel. With microphone bias voltage.
PORTB_R	35	I	Ia	Microphone Input/Line Input, Right Channel. With microphone bias voltage.
B_BIAS	33	REF	REF	Microphone Bias Voltage for Port B.
PORTC_L	30	I	Ia, Oa	Microphone Input/Line Input/Line Output, Left Channel. With microphone bias voltage.
PORTC_R	31	I	Ia, Oa	Microphone Input/Line Input/Line Output, Right Channel. With microphone bias voltage.
C_BIAS	32	REF	REF	Microphone Bias Voltage for Port C.
LEFT+	11	O	Oa	Class-D Amplifier Output, Left Channel, Positive.
LEFT-	13	O	Oa	Class-D Amplifier Output, Left Channel, Negative.
RIGHT+	16	O	Oa	Class-D Amplifier Output, Right Channel, Positive.
RIGHT-	14	O	Oa	Class-D Amplifier Output, Right Channel, Negative.
PORTA_L	22	O	Oa	Headphone Output/Line Output, Left Channel. This is a ProCoustic (cap-less) headphone output.
PORTA_R	23	O	Oa	Headphone Output/Line Output, Right Channel. This is a ProCoustic (cap-less) headphone output.

Table 3. CX20671 Pad Signal Definitions (4 of 4)

Label	Pad Number	Type	I/O Type	Signal Name/Description
SENSE_A	36	I	Ia	SENSE A Input.
Reserved/Not Used				
NC	25	-	-	Not Used. Leave unconnected.
NC	24	-	-	Not Used. Leave unconnected.
NC	39	-	-	Not Used. Leave unconnected.
GENERAL NOTES:				
<u>I/O types:</u> Ia Analog input Oa Analog output Od Digital output Ohd Digital output, HD Audio-compatible Id Digital input, with pull-down Ihd Digital input, HD Audio-compatible It Digital input, TTL-compatible				

[Table 4](#) lists the device's absolute maximum ratings.

[Table 5](#) lists the electrical characteristics for the Digital Mic interface.

[Table 6](#) lists the devices' DC characteristics for the TTL-compatible I/Os.

[Table 7](#) lists the host's required DC characteristics for the HD Audio interface signals.

Table 4. Absolute Maximum Ratings

Parameter	Symbol	Limits	Units
Supply Voltage	DVDD_3.3	3.6	V
	VAUX_3.3	3.6	
	VDD_IO	3.6/1.65 ⁽¹⁾	
	AVDD_HP	3.6	
	AVDD_5V	5.5	
	RPWR_5.0	5.5	
	LPWR_5.0	5.5	
Digital Input Voltage	V_{ind}	-0.7 to 4.0	V
Analog Input Voltage	V_{ina}	-0.7 to 4.0	V
DC Clamp Current, Input	I_{ik}	± 20	mA
DC Clamp Current, Output	I_{ok}	± 20	mA
Storage Temperature Range	T_{stg}	-55 to 125	°C
FOOTNOTES:			
⁽¹⁾ Depends on 3.3 volts or 1.5 volts HD Audio signaling level.			

Table 5. DC Characteristics – Digital Microphone

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Input Voltage Low	V_{IL}	-0.3	—	0.94	V	Max. value adjustable
Input Voltage High	V_{IH}	1.2	—	3.3	V	
Output Voltage Low	V_{OL}	—	—	0.4	V	
Output Voltage High	V_{OH}	2.6	—	—	V	
Drive Strength		0.3	4	6.8	mA	Adjustable
GENERAL NOTES: Test Conditions unless otherwise stated: DVDD = +3.3 ± 0.165 VDC; TA = 0°C to 70°C.						

Table 6. DC Characteristics – TTL Compatible (EAPD#, GPIOs)

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Input Voltage	V_{IN}	—	—	4.0	V	
Input Voltage Low	V_{IL}	-0.5	—	0.8	V	
Input Voltage High	V_{IH}	2.0	—	Vdd+0.5	V	
Output Voltage Low	V_{OL}	0	—	0.4	V	
Output Voltage High	V_{OH}	2.4	—	Vdd	V	
GPIO Output sink current at 0.4 V maximum	—	—	—	12	mA	
GPIO Output source current at 2.97 V minimum	—	—	—	12	mA	
GPIO rise/fall time	—	—	—	4	ns	25% to 75%
GENERAL NOTES: Test Conditions unless otherwise stated: DVDD = +3.3 ± 0.165 VDC; TA = 0°C to 70°C; external load = 50 pF						

Table 7. Host Signal Characteristics – HD Audio

Parameter	Symbol	Minimum	Maximum	Units	Test Conditions
HD Audio Signal Levels at 3.3 V					
VDD_IO	V_{CC}	3.135	3.465	V	$V_{CC} < VDD + 0.5 V$
Input High Voltage	V_{IH}	$0.65 \times V_{CC}$		V	
Input Low Voltage	V_{IL}		$0.35 \times V_{CC}$	V	
Output High Voltage	V_{OH}	$0.9 \times V_{CC}$		V	$I_{OUT} = 500 \mu A$
Output Low Voltage	V_{OL}		$0.10 \times V_{CC}$	V	$I_{OUT} = 1500 \mu A$
Output High Voltage - AC Drive Point	V_{OHAC}	$0.7 \times V_{CC}$		V	$I_{OUT} = -15 \times V_{CC} mA$
Output Low Voltage - AC Drive Point	V_{OLAC}		$0.3 \times V_{CC}$	V	$I_{OUT} = 15 \times V_{CC} mA$
Input leakage Current	I_{IL}		± 10	μA	$0 < V_{IN} < V_{CC}$
HD Audio Signal Levels at 1.5 V					
VDD_IO	V_{CC}	1.35	1.65	V	$V_{CC} < VDD + 0.5 V$
Input High Voltage	V_{IH}	$0.6 \times V_{CC}$		V	
Input Low Voltage	V_{IL}		$0.4 \times V_{CC}$	V	
Output High Voltage	V_{OH}	$0.9 \times V_{CC}$		V	$I_{OUT} = 500 \mu A$
Output Low Voltage	V_{OL}		$0.10 \times V_{CC}$	V	$I_{OUT} = 1500 \mu A$
Output High Voltage - AC Drive Point	V_{OHAC}	$0.7 \times V_{CC}$		V	$I_{OUT} = -9.38 \times V_{CC} mA$
Output Low Voltage - AC Drive Point	V_{OLAC}		$0.3 \times V_{CC}$	V	$I_{OUT} = 9.38 \times V_{CC} mA$
Input leakage Current	I_{IL}		± 10	μA	$0 < V_{IN} < V_{CC}$
GENERAL NOTES:					
1. The supply voltage refers to the VDD_IO pin.					
2. Test Conditions unless otherwise stated: DVDD = +3.135V to +3.465 V; TA = 0 °C to 70 °C.					

Figure 5. Output Buffer for 3.3 V Signaling

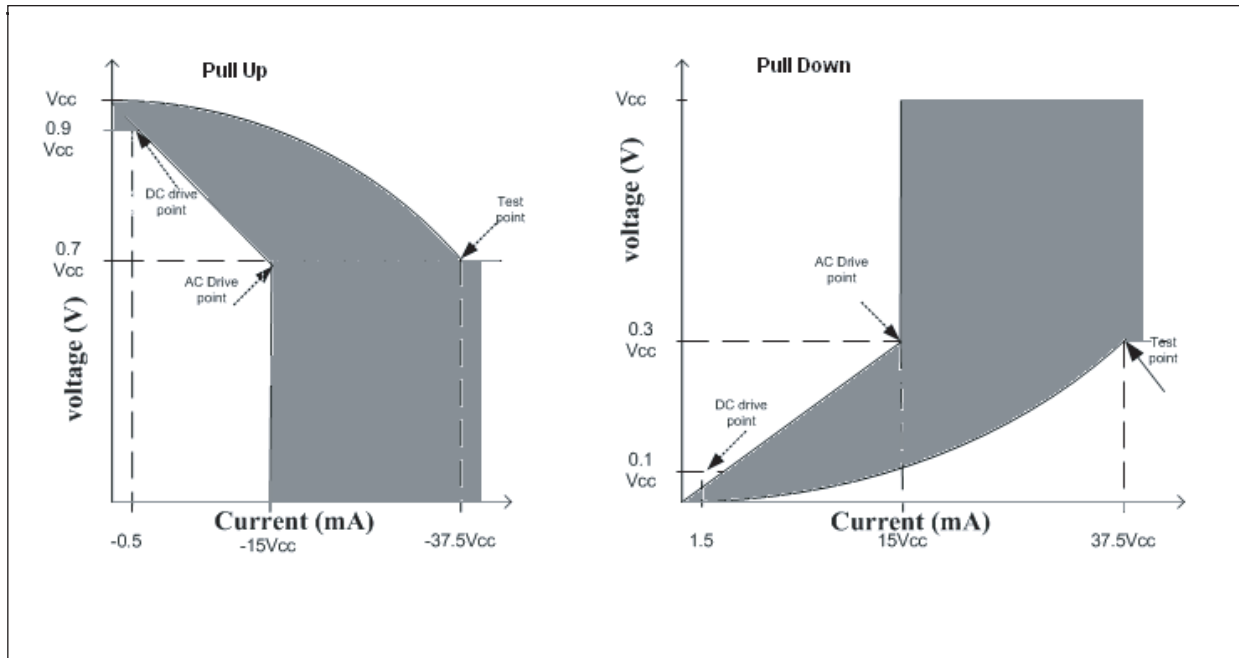
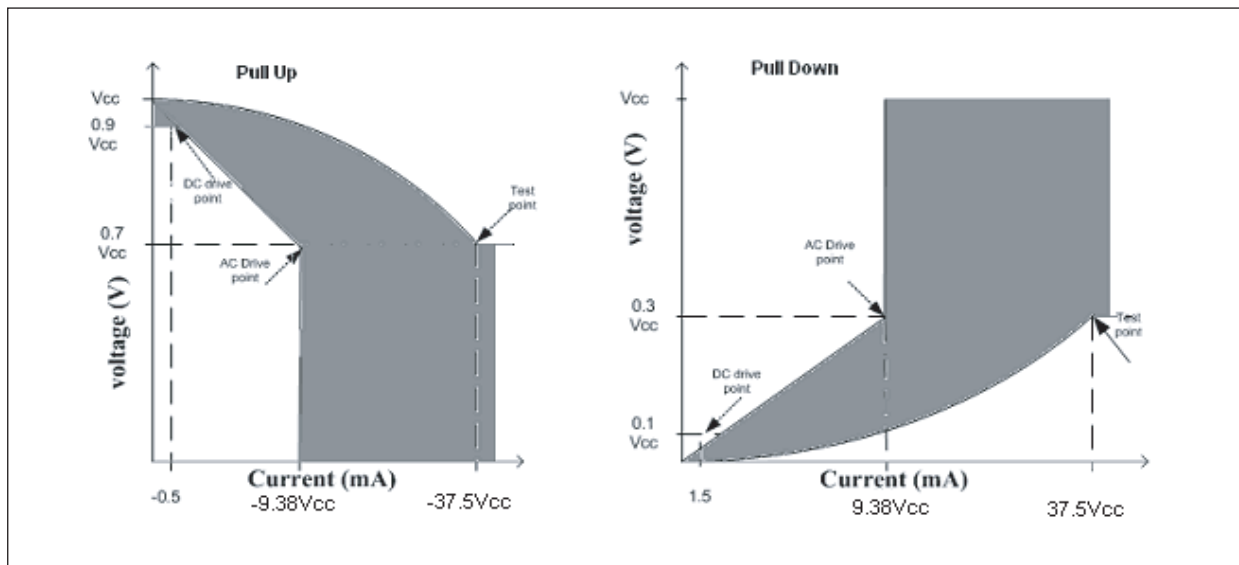


Figure 6. CX20671 Output Buffer for 1.5 V Signaling



2.4 Device Performance Specifications

The following tables and graphs illustrate the device's analog performance.

Table 8. CX20671 Analog Performance Characteristics (1 of 2)

Parameter	Minimum	Typical	Maximum	Units
Line Outputs				
Full Scale Output Voltage	1.0			Vrms
Dynamic Range (measured with -60 dBFS signal present)		97		dBFS
Total Harmonic Distortion + Noise (THD + N), measured at -3 dBFS		-90	-93	dB
Channel Crosstalk		-84		dBFS
Analog Frequency Response (+/- 3 dB at 20 Hz, +/- 1 dB at 20000 Hz)	20		20000	Hz
Headphone Output				
Full Scale Output Voltage		1.2		Vrms
Dynamic Range (measured with -60 dBFS signal present)		97		dBFS
Total Harmonic Distortion + Noise (THD + N), measured at -3 dBFS		-85		dB
Channel Crosstalk		-75		dBFS
Analog Frequency Response (+/- 3 dB at 20 Hz, +/- 1 dB at 20000 Hz)	20		20000	Hz
Class-D Speaker Amplifier Outputs				
Full Scale Output Voltage (into 4 Ω)	3.96 2.83	4.0 2.90	4.2 3	Vp Vrms
Dynamic Range (measured with -60 dBFS signal present)		92		dBFS
Total Harmonic Distortion + Noise (THD + N, measured at -3 dBFS)		-70		dBFS
Analog Frequency Response (+/- 3 dB at 20 Hz, +/- 1 dB at 20000 Hz)	20		20000	Hz
Efficiency (Measured at 1 W/Ch)		85		%
Line Inputs				
Full Scale Input Voltage	1.0			Vrms
Dynamic Range (measured with -60 dBFS signal present)		89		dBFS
Total Harmonic Distortion + Noise (THD + N), measured at -3 dBFS		-87		dB
Channel Crosstalk		-84		dBFS
Analog Frequency Response (+/- 3 dB at 200 Hz, +/- 1 dB at 20000 Hz)	200		20000	Hz

Table 8. CX20671 Analog Performance Characteristics (2 of 2)

Parameter	Minimum	Typical	Maximum	Units
Line Inputs (continued)				
Input Resistance 0 dB 10-40 dB		15.8 5.0		k Ω
Input Capacitance		5		pF
Microphone Inputs				
Full Scale Input Voltage (With 20 dB boost) Full Scale Input Voltage (With boost off)	0.1 1.0			Vrms
Dynamic Range (measured with -60 dBFS signal present)		89		dBFS
Total Harmonic Distortion + Noise (THD + N), measured at -3 dBFS		-83.4		dBFS
Channel Crosstalk (measured at 1 kHz, 0 dB gain)		-84		dBFS
Analog Frequency Response (+/- 3 dB at 200 Hz, +/- 1 dB at 20000 Hz)	200		20000	Hz
Input Resistance 0 dB 10-40 dB		15.8 5.0		k Ω
Input Capacitance		5		pF

Figure 7. Class-D Speaker Amplifier Magnitude Frequency Response (16 bit, 48 kHz)

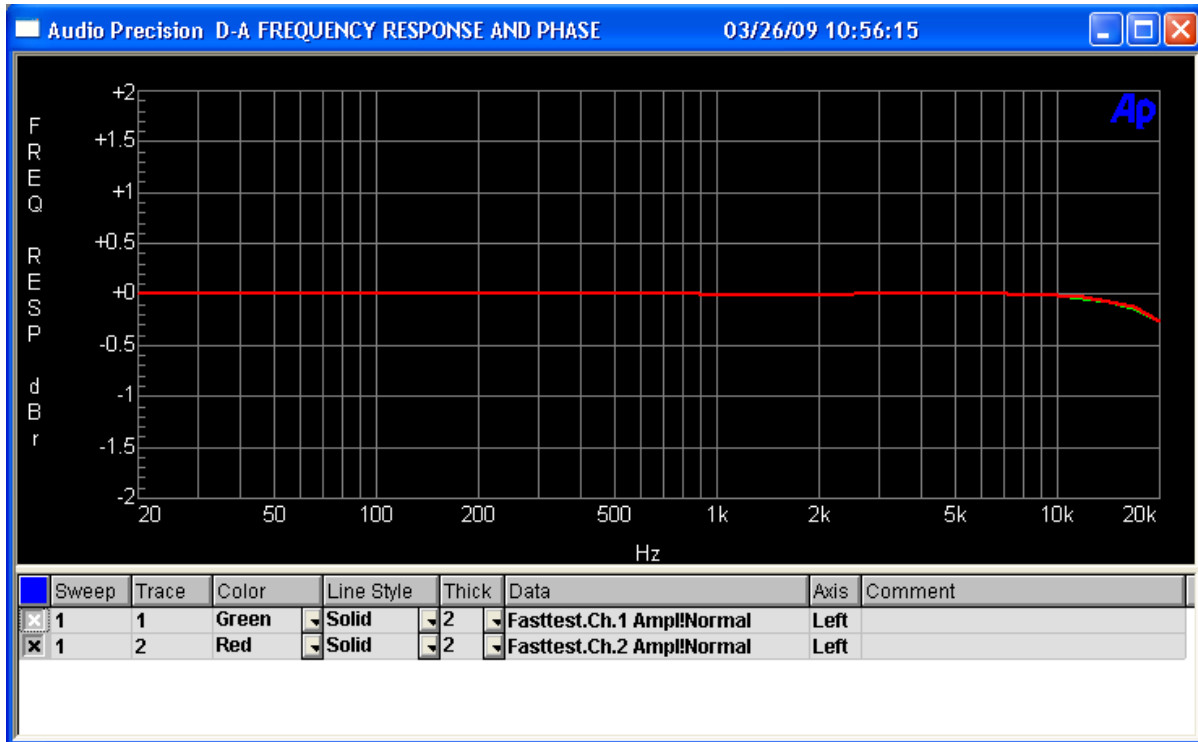


Figure 8. CX20671 THD+N versus Frequency, for Class-D Amplifier Output

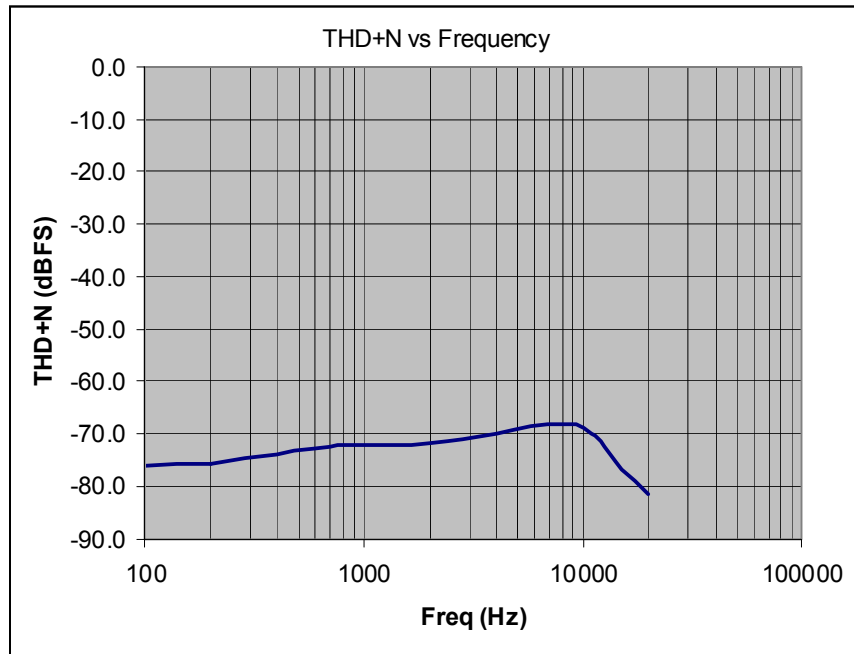


Figure 9. CX20671 Power Supply Rejection, for Class-D Amplifier Output

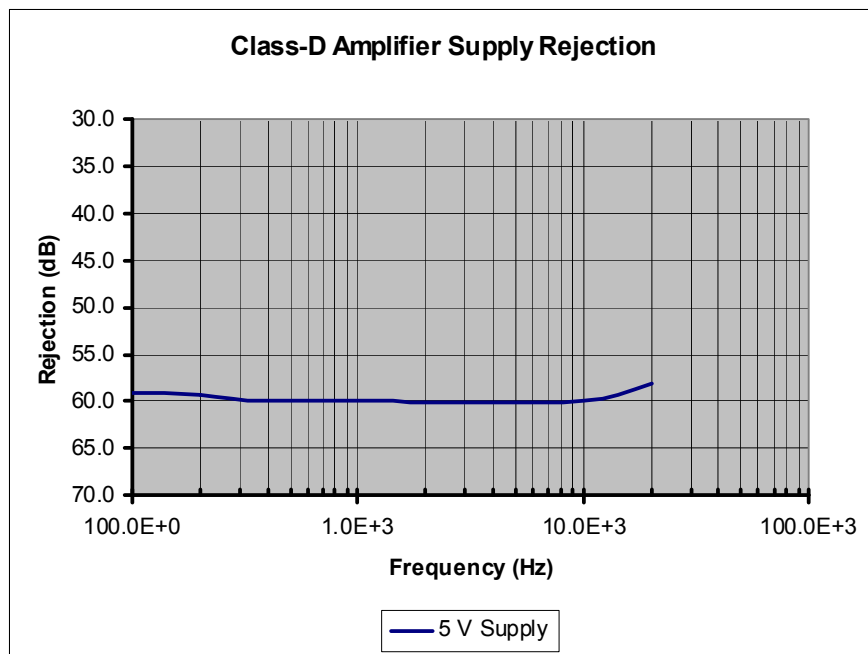


Figure 10. CX20671 Power Supply Rejection, for Headphone Amplifier Output

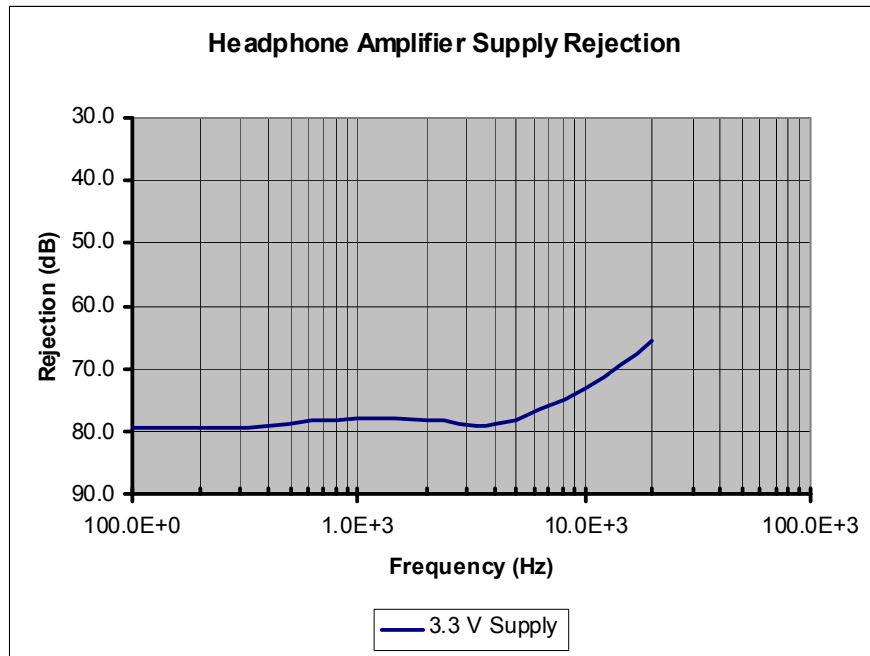
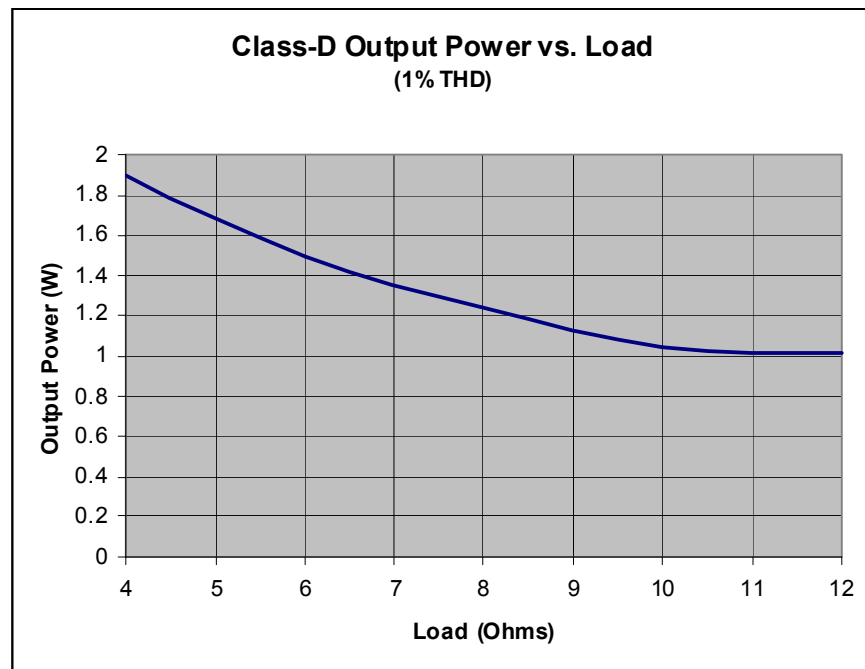


Figure 11. CX20671 Class-D Output Power vs. Load (1% THD)



2.5 Power Management and Power Consumption

2.5.1 Power Management

Advanced power management features allow the device to conserve additional power by disabling/enabling individual functional blocks. This is shown in [Table 9](#).

Table 9. Power Management

Functional Block	D0 (S0-Idle)	D2 (S0-Idle) Pre-ECR 15B	D3 (S0-Idle) EPSS ECR 15B	D-Flex ⁽¹⁾	D3 (S3) or D4 (S3) ⁽²⁾	D3 (S4) or D4 (S4) ⁽³⁾
DAC	On	Off	Off	Flex mode	Off	Off
ADC	On	Off	Off	Flex mode	Off	Off
Ports	On	Off	Off	Flex mode	Off	Off
Headphone Amps	On	Off	Off	Flex mode	Off	Off
5V LDO	On	On	On	On	Off ³	Off ³
Class-D Amp	On	Off	Off	Flex mode	Off	Off
Reference Voltage (1.65 V)	On	On	On	On	Off	Off
Port Sense	On	On	On	On	Off	Off
HD-Audio Bus	On	On	On	On	Off	Off
Reg Banks	On	On	On	On	On	Off
AVDD_HP Supply	On	On	On	On	Off ⁽³⁾	Off
DVDD_3.3 Supply	On	On	On	On	Off ⁽³⁾	Off
VDD_IO Supply	On	On	On	On	On	Off
VAUX_3.3 Supply	On	On	On	On	On	Off

FOOTNOTES:

⁽¹⁾ D-Flex mode requires loading Conexant proprietary driver. D-Flex will conserve additional power by disabling/enabling certain digital and analog blocks in the codec based on the audio activity.

⁽²⁾ In EPSS ECR-15B, the device will be set to D4 when the system goes to S3 or S4.

⁽³⁾ The supplies may remain on or off depending on the system.

Table 10. Device Power State Mapping

Device State (Pre-ECR 15B)	Device State (EPSS ECR 15B)	System State	Wake-up Time	Description
D0	D0	S0	--	Device is in Full Power
D1	D1, D2	S0-Idle	1 ms	Lower power standby (LP1). Transition time to full power is 1 ms.
D2	D3	S0-Idle	10 ms	Lowest power standby (LP2). Transition time to full power is 10 ms, and additional 75 ms for Full Fidelity.
			75 ms	
D3	D4	S3	200 ms	Standby, prepare for shutdown (SD). Transition time to full power 200 ms.
D3	D4	S4	200 ms	Hibernate, prepare for shutdown (SD). Transition time to full power 200 ms.

2.5.2 Power Supply Current Consumption

Table 11 shows the required voltages at the various supply input pins of the devices.

Table 11. CX20671 DC Supply Voltages

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Digital Voltage Supply	DVDD_3.3	3.165	3.3	3.465	V	
Standby Voltage Supply	VAUX_3.3	3.165	3.3	3.465	V	
HDA Bus Signaling Supply, 3.3V	VDD_IO	3.165	3.3	3.465	V	
HDA Bus Signaling Supply, 1.5 V	VDD_IO	1.425	1.5	1.575	V	
Class-D Amp Supply, Left Ch.	LPWR_5.0	4.75	5.0	5.25	V	
Class-D Amp Supply, Left Ch	RPWR_5.0	4.75	5.0	5.25	V	
Headphone Voltage Supply	AVDD_HP	3.165	3.3	3.465	V	
5V-to-3.3V Regulator Input	AVDD_5V	4.75	5.0	5.25	V	

Additionally, the following power-sequencing requirements must be met:

- ◆ For best performance of audible pop/click suppression, VAUX_3.3 supply should always ramp up before any of the other power supplies, and should ramp down after all other power supplies have ramped down. It is highly recommended that VAUX_3.3 voltage be near its final value before beginning ramp-up of AVDD_5V rail.
- ◆ DVDD_3.3 should always be present when AVDD_5V is present. If DVDD_3.3 is removed when AVDD_5V is present, the device may be damaged.

- ◆ All 5 V supplies (AVDD_5V, LPWR_5.0, RPWR_5.0) can be removed while DVDD_3.3 is present.
- ◆ To support Wake-On-Jack functionality, VAUX_3.3 and VDD_IO should be powered from a power supply that is never removed (unless AC power is removed). If no such support is required, VAUX_3.3 and VDD_IO can be powered from same supply as DVDD_3.3. Sense resistors should ALWAYS use same supply as VAUX_3.3 power pin.

The current and power consumption for each of the power pins is shown in [Tables 12 through 15](#).

Table 12. D0 (S0) Full-Duplex Power Consumption

	D0 (S0-Full Duplex) ⁽¹⁾		
	Pre ECR-15B Class Driver	Pre ECR-15B CNXT Driver	EPSS (ECR-15B) Class Driver
5V Class-D (mA)	1007.3	1008.01	1007.3
5V LDO (mA)	12.7	21.99	12.7
AVDD_HP (mA)	0.4	0.5	0.4
DVDD_3.3 (mA)	0.8	0.7	0.8
VDD_IO (mA)	0.031	0.061	0.031
VAUX_3.3 (mA)	48.7	46.2	48.7
Class-D Power (mW)	5036.50	5040.05	5036.50
LDO Power (mW)	21.59	37.38	21.59
Rest of the chip (mW)	206.68	229.19	206.68
Total Power (mW)	5264.77	5306.62	5264.77
FOOTNOTES:			
⁽¹⁾ Transmitting full-scale sinewave from Class-D, recording using analog microphone.			

Table 13. Pre-ECR15B D-States Power Consumption With Class Driver

	Pre ECR-15B D-States (Class Driver)		
	D0 (S0-Idle)	D3 (S3) ⁽¹⁾	D3 (S4) ⁽¹⁾
5V Class-D (mA)	7.6	0.6	0
5V LDO (mA)	18.28	0.95	0
AVDD_HP (mA)	0.5	0.4	0
DVDD_3.3 (mA)	0.7	0.1	0
VDD_IO (mA)	0.035	0.007	0.000
VAUX_3.3 (mA)	46.9	2.2	0
Class-D Power (mW)	38.00	3.00	0.00
LDO Power (mW)	31.08	1.62	0.00
Rest of the chip (mW)	219.17	12.07	0.00
Total Power (mW)	288.25	16.68	0.00
FOOTNOTES:			
⁽¹⁾ In Suspend mode (S3 or S4), the device state will be D3.			

Table 14. Pre-ECR15B D-States Power Consumption With Conexant Driver

	Pre ECR-15B D-States (Conexant Driver)		
	D2 (S0-Idle)	D3 (S3) ⁽¹⁾	D3 (S4) ⁽¹⁾
5V Class-D (mA)	0.6	0.5	0
5V LDO (mA)	1.02	0.99	0
AVDD_HP (mA)	0.4	0.4	0
DVDD_3.3 (mA)	0.1	0.1	0
VDD_IO (mA)	0.036	0.007	0.000
VAUX_3.3 (mA)	6.8	2.1	0
Class-D Power (mW)	3.00	2.50	0.00
LDO Power (mW)	1.73	1.68	0.00
Rest of the chip (mW)	27.57	11.87	0.00
Total Power (mW)	32.31	16.05	0.00
FOOTNOTES:			
⁽¹⁾ In Suspend mode (S3 or S4), the device state will be D3.			

Table 15. EPSS ECR15B D-States Power Consumption with Conexant Driver

	EPSS ECR-15B D-States (Conexant Driver)		
	D3 (S0-Idle) ⁽¹⁾	D4 (S3) ⁽²⁾	D4 (S4) ⁽²⁾
5V Class-D (mA)	0.6	0.5	0
5V LDO (mA)	1.02	0.99	0
AVDD_HP (mA)	0.4	0.4	0
DVDD_3.3 (mA)	0.1	0.1	0
VDD_IO (mA)	0.134	0.007	0.000
VAUX_3.3 (mA)	2	2.1	0
Class-D Power (mW)	3.00	2.50	0.00
LDO Power (mW)	1.73	1.68	0.00
Rest of the chip (mW)	12.06	11.87	0.00
Total Power (mW)	16.79	16.05	0.00
FOOTNOTES:			
⁽¹⁾ In S0-Idle mode, the device will be set to D3; BCLK is removed.			
⁽²⁾ In Suspend mode (S3 or S4), the device state will be D4. In S4 mode, power supplies are removed.			

2.5.3 Integrated Low-Dropout Regulators

The devices feature two integrated low-dropout voltage regulators:

- ◆ A 5 V to 3.3 V regulator: The output of this voltage regulator (AVDD_3.3) can be used to power external circuitry (low-power analog for example). However, external current consumption from the regulator should be limited to no more than 30 mA. Additionally, caution should be used when powering external circuitry; use filtering (ferrite bead + capacitor, for example) to prevent the external circuitry from adding noise to the AVDD_3.3 voltage rail.
- ◆ A 3.3 V to 1.8 V regulator: The output of this voltage regulator (FILT_1.8) can also be used to power external circuitry (discrete logic, for example).

2.6 Integrated High-Pass Filter

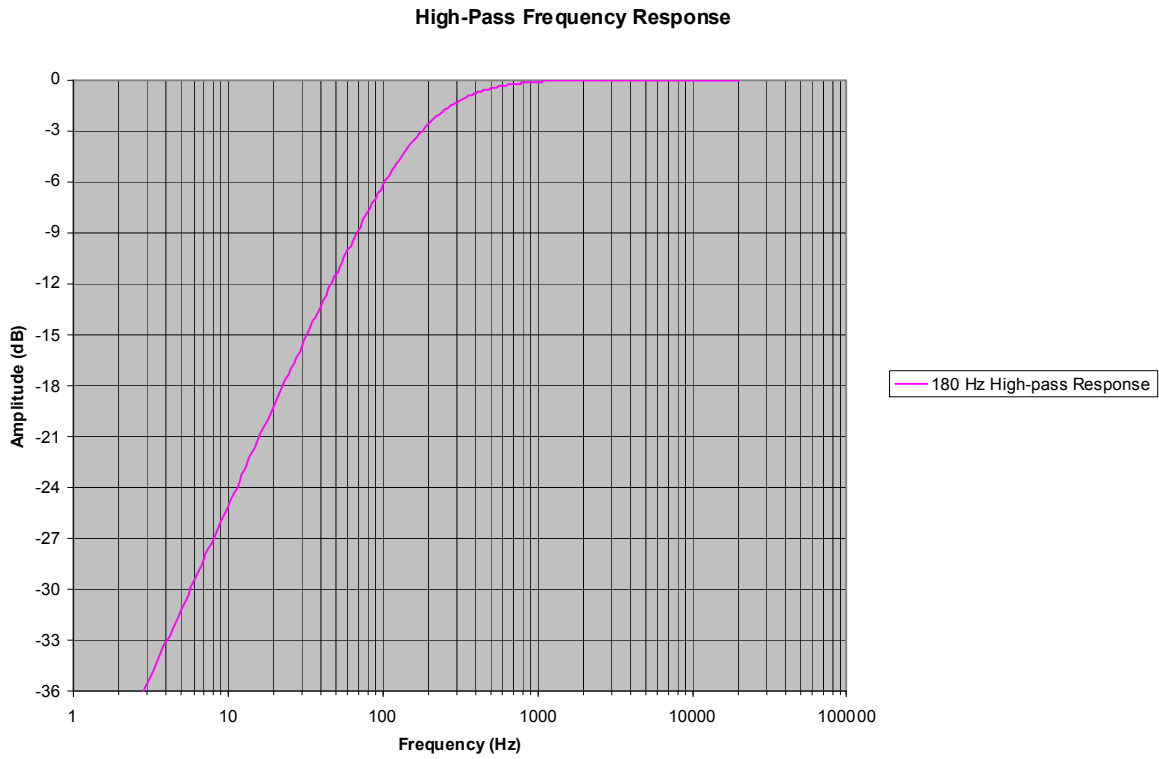
The CX20671 device features a hardware digital high-pass filter, intended to be used with the class-D speaker amplifier. The cut-off frequency can be adjusted from 15 Hz to 945 Hz, in 15-Hz steps (30 Hz to 1890 Hz, in 30-Hz steps for -21Z devices), depending on the value present in the appropriate 6-bit control register. Note that a setting of 000000b in the control register bypasses the filter.

By default, the high-pass filter is automatically applied to the DAC that is connected (mapped) to the class-D speaker amplifier. This “DAC tracking” mode can be disabled, and the high-pass filter can be applied to any DAC, regardless of the port connected to it. There are two ways to set the high-pass cut-off frequency:

- ◆ DAC tracking mode: This is the typical mode of operation. This mode needs to be enabled, as it is not the default mode. The high-pass filter tracks the DAC that is connected to (mapped to) the class-D amplifier, but the 3 dB frequency is manually set by writing to the 6-bit control register.
- ◆ Fully manual mode: This mode needs to be enabled as it is not the default mode. The cut-off frequency can be set manually writing to the 6-bit control register. The DAC to which the filter is applied can also be selected manually by writing to the appropriate control register. Note that no typical application will use this mode.

The high-pass filter response for a specific setting is shown in the figure below. Note that, since it is a first-order filter, it rolls off at -20 dB/decade, or -6 dB/octave.

Figure 12. High-Pass Filter Response



The location of registers used to control the high-pass filter cut-off frequency is in Node ID 25h (-11Z devices) and Node ID 27h (-21Z devices)—the Vendor Widget. For additional details, contact Conexant for the application note.

2.7 AC Timing Characteristics

2.7.1 Digital Microphone

The Conexant digital microphone interface on the CX20671 consists of a clock and data pin. The digital mic clock pin provides a 3.072 MHz clock to the digital mic. The digital mic data pin is an input, accepting multiplexed Pulse Density Modulation (PDM) data from the digital mic. Timing waveforms are illustrated in Figure 13, and timing parameters are listed in Table 16.

Contact Conexant Sales FAE for a list of qualified digital microphones.

Figure 13. Digital Mic Clock Timing Waveform

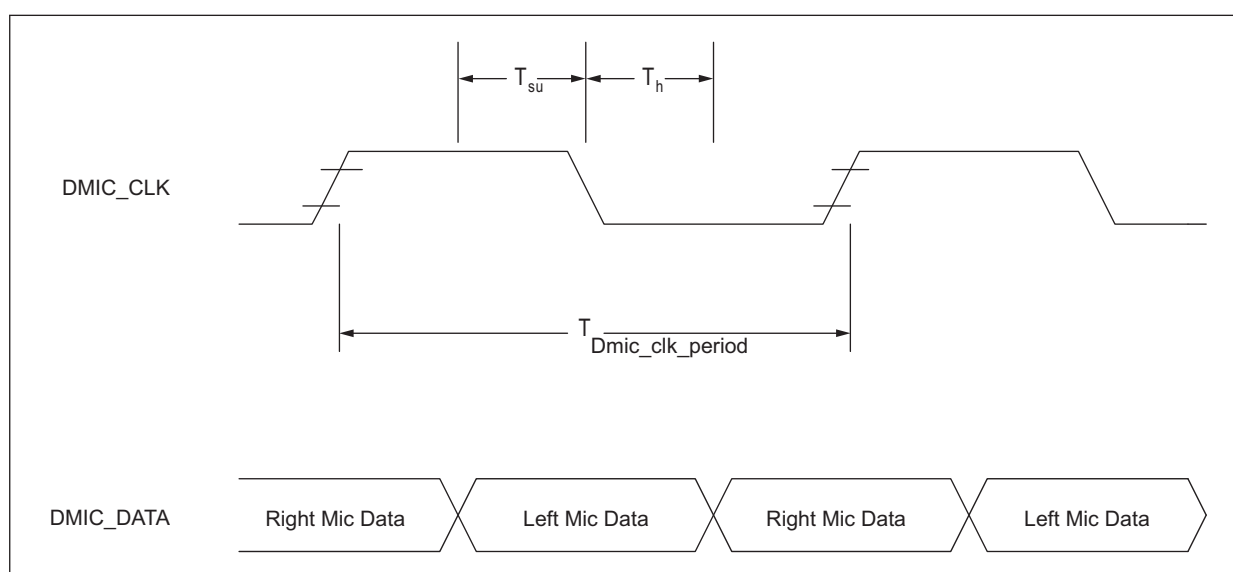


Table 16. Digital Mic Timing Parameters

Parameter	Symbol	Minimum	Typical	Maximum	Units
DMIC_CLK frequently ⁽¹⁾		3.0689	3.072	3.0751	MHz
DMIC_CLK period	$T_{Dmic_clk_period}$	325.19	325.52	325.85	ns
DMIC_CLK transition period @ 50 pF ⁽²⁾		—	—	4	ns
DMIC_CLK transition period @ 20 pF ⁽²⁾		—	—	1.9	ns
DMIC_CLK transition period @ 7 pF ⁽²⁾		—	—	1	ns
DMIC_DATA setup time	T_{su}	—	36	—	ns
DMIC_DATA hold time	T_h	0	—	—	ns

FOOTNOTES:
⁽¹⁾ Worst case duty cycle restricted to 40/60.
⁽²⁾ Measured between 25% and 75% full scale.

2.7.2 HD Audio Clocks

The BIT_CLK signal is a 24 MHz clock sourced from the HD Audio controller and connecting to all codecs on the link.

HD Audio clock waveforms and timing parameters are shown in [Figure 14](#) and [Table 17](#).

Figure 14. BIT_CLK and SYNC Timing Waveforms

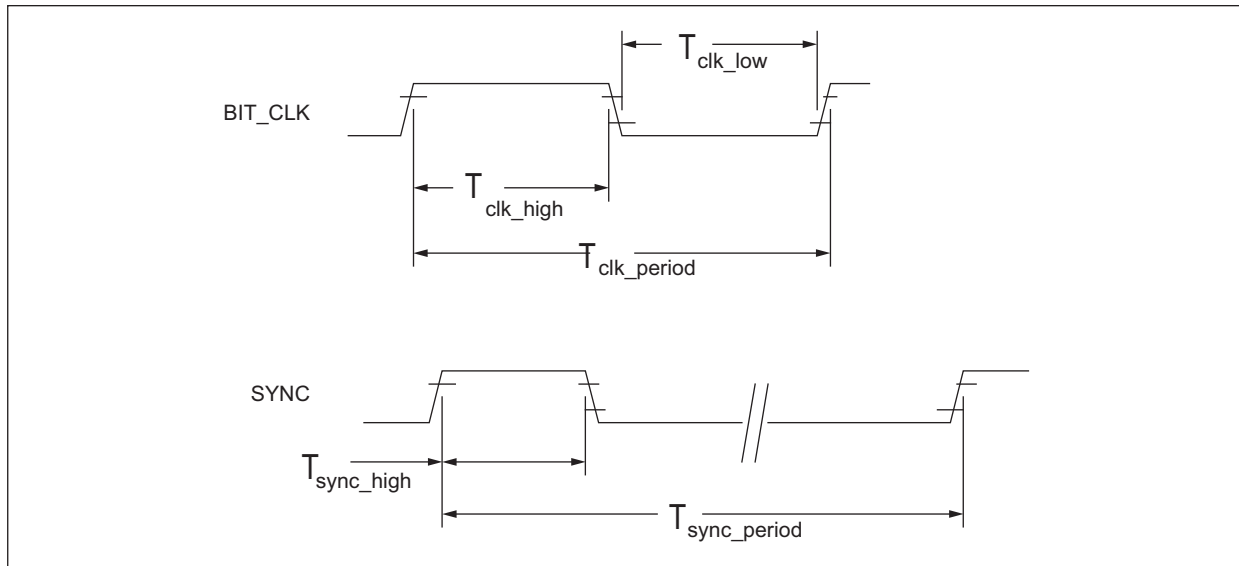


Table 17. BIT_CLK and SYNC Timing Parameters

Parameter	Symbol	Minimum	Typical	Maximum	Units
BIT_CLK frequency		23.9976	24.0	24.0024	MHz
BIT_CLK period	T_{clk_period}	41.363	41.67	41.971	ns
BIT_CLK output jitter		—	150	500	Ps
BIT_CLK high pulse width ^{(1) (2)}	T_{clk_high}	18.75	—	22.91	ns
BIT_CLK low pulse width ^{(1) (2)}	T_{clk_low}	18.75	—	22.91	ns
SYNC frequency ⁽³⁾		—	48	—	kHz
SYNC period	T_{sync_period}	—	20.8	—	μ s
SYNC high pulse width	T_{sync_high}	—	$4 \times T_{clk_period}$	—	μ s

FOOTNOTES:

⁽¹⁾ 47.5–70 pF external load.

⁽²⁾ Worst case duty cycle restricted to 40/60.

⁽³⁾ The SYNC frequency is equal to the BIT_CLK frequency divided by 500.

2.7.3 Data Output and Input

Data output and input waveforms are illustrated in Figure 15. Timing parameters are listed in Tables 18 and 19.

Figure 15. Data Output and Input Timing Waveforms

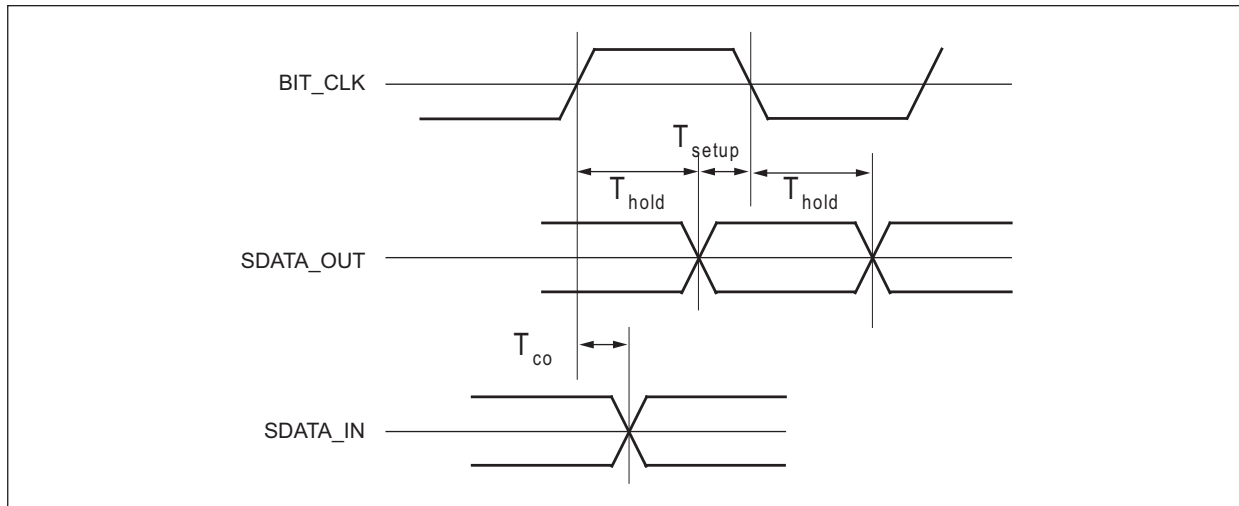


Table 18. HD Audio Output Valid Delay Timing Parameters

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output Valid Delay from rising edge of BIT_CLK	Tco	3	—	11	ns

GENERAL NOTES:

- Timing is for SDATA and SYNC outputs with respect to BIT_CLK at the device driving the output.
- 50 pF external load.

Table 19. HD Audio Input Setup and Hold Timing Parameters

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Setup at both rising and falling edge of BIT_CLK	Tsetup	5	—	—	ns
Input Hold at both rising and falling edge of BIT_CLK	Thold	5	—	—	ns

GENERAL NOTES:

- Timing is for SDATA and SYNC inputs with respect to BIT_CLK at the device latching the input.
- The CX20671 does not impose a maximum value on the system.

2.8 CX20671 Package Dimensions

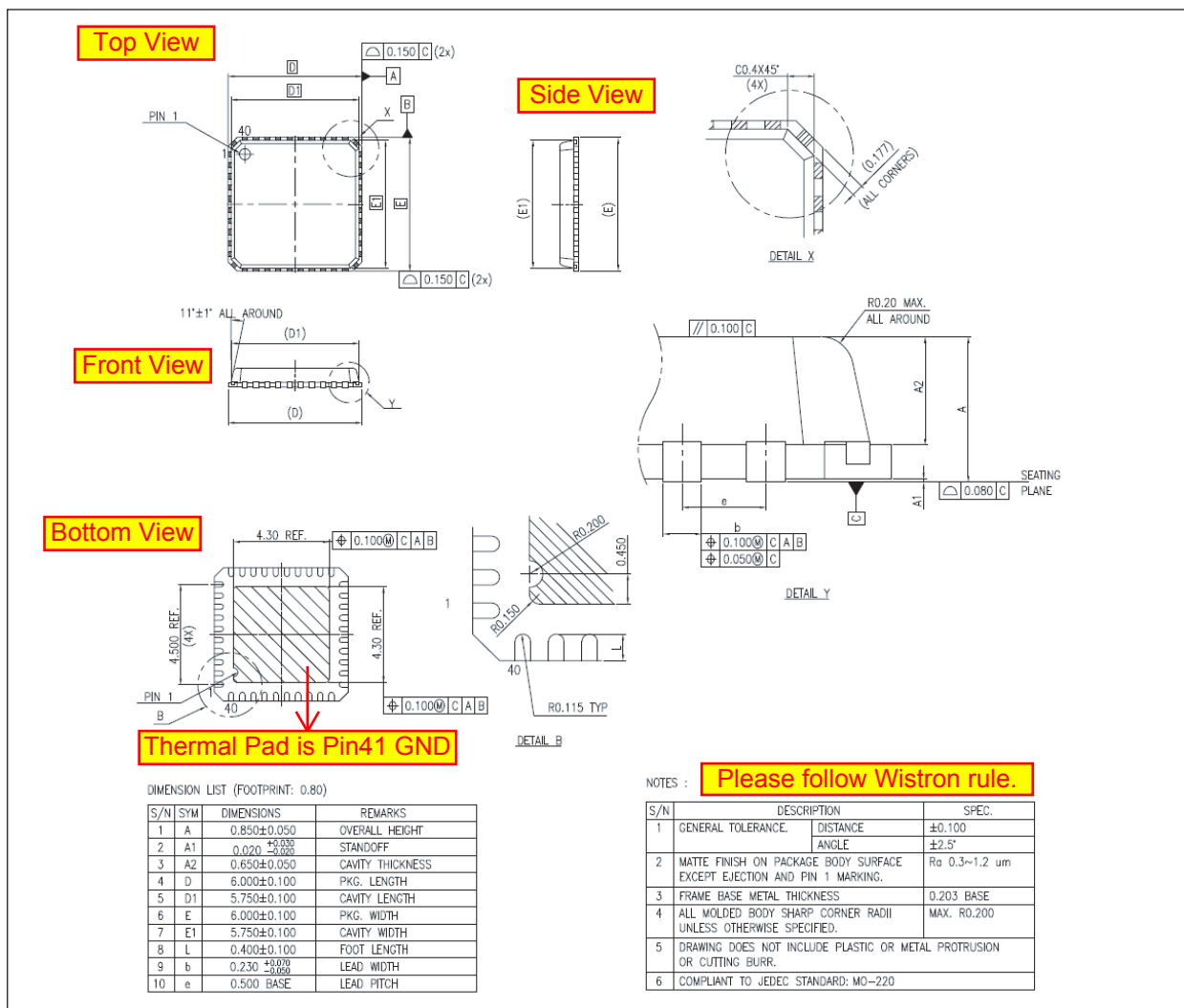
The devices are packaged as shown in Table 20.

Table 20. Package Dimensions

Device	Package Description	Package Length/Width/ Overall Height (mm)	Lead Width/Lead Pitch (mm)
CX20671	40-QFN	6.00/6.00/0.85	0.230/0.500

The package drawing for the device is shown in Figure 16.

Figure 16. CX20671 40-QFN Package Drawing



HD Audio Interface

Verbs are commands and queries that are passed from the HD Audio Controller to the codecs on the HD Audio bus. Responses are data-passed from the HD Audio codec to the HD Audio Controller. All Controller Verbs must be followed by a Codec Response, Unsolicited Responses from the codec is data transmitted without a Controller verb request.

A “1” in the Valid bit position indicates the Response Field contains a valid response. A “1” in the UnSol bit position is meaningful only when the Valid bit is set and indicates that the response is Unsolicited rather than in reply to a verb. The 32 actual response bits vary in format and are each documented in the HD Audio Specification defined by Intel.

For more information regarding verbs and Controller and Codec Command and Control protocol, refer to the HD Audio Specification from Intel Corporation.

3.1 HD Audio Interface Overview

The HD Audio interface is a 5-pin interface: Clock (BIT_CLK), serial data in (SDATA_IN), serial data out (SDATA_OUT), SYNC, and RESET#. The clock is provided by the controller at a frequency of 24 MHz. The SDATA_OUT signal is provided by the controller and contains data for every edge of the 24 MHz clock. Therefore, the CX20671 must sample data on both rising and falling edges of SDATA_OUT.

Sync not only signals the beginning of the 500 clock frame; it designates the beginning of the data for each stream and indicates which stream of data will be on SDATA_OUT next. (Streams do not need to appear in order, the controller may do as it likes.) Channels are another way of organizing the serial data. Each stream has at least one channel. Each stream must start with channel 0 and proceed without interruption until all the assigned channels are exhausted. A stereo pair takes two adjacent channels. So, if DAC1 is in stereo mode and DAC1 is assigned channel 0 then the left data will be on channel 0 and the right on channel1. If DAC2 were then assigned channel 2 and it were also stereo (and the same stream as DAC1) its left data would be on channel 2 and its right on channel 3.

SDATA_IN contains the CX20671 data headed towards the controller. It is only generated on rising edges. This includes information read from the HD Audio “registers”, ADC and incoming modem data. Stream and channel is indicated before the data is transmitted on SDATA_IN. See the HD Audio specification for that format. SDATA_IN is also responsible for knowing which device number (CAD in the HD Audio specification). During the last clock of the first sync after a power on reset, the SDATA_IN is driven high by CX20671 for one clock cycle. This indicates to the controller the need for a CAD. The CX20671 then stops driving the SDATA_IN signal and the controller begins to drive it. The controller drives SDATA_IN high through the

next sync, and the CAD is assigned by the number of clocks after the fall of sync that it takes for the SDATA_IN to fall. Then, the interface turns around again, and SDATA_IN is an output from CX20671 until reset.

The HD Audio specification also contains one other concept that is worth mentioning. That is the concept of an unsolicited message. Unsolicited messages can occur for a number of reasons: timers, ringing phones, answers from the CX20548 device to a register read (etc.). Since the bus has no interrupt, these are taken care of in unsolicited messages. If the controller was not addressing the CAD assigned to the CX20671 during the previous frame, and if one of these unsolicited messages is needed (and enabled), the CX20671 will use the first cycles after the sync on SDATA_IN to alert the controller to the event. Only one event can be signaled in a frame.

The CX20671 will send the message once and only once. It does not expect any sort of acknowledgement from the controller.

3.2 Verbs

This section describes how this device interacts with the Verbs defined in the *High Definition Audio Specification revision 1.0*. Each of the following subsections describes the Verb ID's, parameters/payload, and corresponding responses that apply to that node.

Each node in the codec is addressed using a Codec Address (CA_d), assigned to the codec during initialization, and the Node's Unique ID (NID). The concatenation of CA_d and NID provide a unique address allowing commands to reference a single specific node within the audio subsystem.

The entire Verb is formed by pre-pending the CA_d and the NID to the Verb ID and parameter/payload. In the following tables and descriptions, the CA_d and NID are not listed as part of the Verb.

Register values may have up to five letters included with their default value. These letters indicate which of the possible reset events will force the register to its default value. The five resets are as follows:

- ◆ 'P' for power-on reset
- ◆ 'R' for HD Audio reset pin assertion
- ◆ 'V' for single verb reset
- ◆ 'W' for double verb reset
- ◆ 'D' for D-state change reset

Only the letters in the list will force the register to its default value.

Bold values in the tables below, related to Supported Power States, apply when Extended Power State Support (**EPSS**) is enabled. **EPSS** is enabled by default on -21Z devices. For -11Z devices, the indication of **EPSS** support can be enabled in the Test Registers (Vendor-defined Node 25); it is disabled by default.

3.2.1 Node ID 00: Root Node

Table 21 describes a root node that has two function groups, an Audio Function Group (AFG) and a Modem Function Group (MFG).

Table 21. Root Node Parameters and Responses

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Vendor ID	F00h	00h	14F1 5069h		CX20671-11Z
Get Vendor ID	F00h	00h	14F1 506Eh		CX20671-21Z
Get Revision ID	F00h	02h	0010 0301h 0010 0000h		-11Z devices -21Z devices Supports Intel HD Audio 1.0
Get Subordinate Node Count	F00h	04h	0001 0001h		

3.2.2 Node ID 01: Audio Function Group

Table 22 describes an Audio Function Group (AFG).

Table 22. Audio Function Group Node Parameters and Responses (1 of 3)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Subordinate Node Count	F00h	04h	0010 0016h		Starting Node is 10h Node count is 22
Get Function Group Type	F00h	05h	0000 0101h		Node Type is Audio Function Group UnSol Capable is 1
Get Audio Function Group Capabilities	F00h	08h	0001 0F0Fh		PC Beep generator is present Input sample delay is 0Fh Output sample delay is 0Fh
Get Supported PCM Size, Rates	F00h	0Ah	000E 0160h		16, 20, and 24 bit audio formats supported 44.1, 48, and 96 kHz sample rates supported
Get Supported Stream Formats	F00h	0Bh	0000 0001h		PCM format is supported
Get Supported Power States	F00h	0Fh	C000 001Fh 4000 001Fh		EPSS, clock stop, D0, D1, D2, D3, and D4 Bold is with EPSS supported (default for -21Z)
Get GPIO Count	F00h	11h	4000 0004h		Four (4) GPIOs with GPIOUnSol capability

Table 22. Audio Function Group Node Parameters and Responses (2 of 3)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Power State	F05h	00h	0000 0abch	0000 0633h (P,W)	Gets power state of node to which it refers a = Settings reset b = Actual power state c = Requested power state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		Sets power state of node to which it refers a = Requested power state
Get Unsolicited Response	F08h	00h	0000 00aah	0000 0000h (P,W)	aa = Unsolicited Response enable and tag
Set Unsolicited Response	708h	aah	0000 0000h		aa = Unsolicited Response enable and tag
Get GPIO Data	F15h	00h	0000 000ah	0000 0000h (P,W)	a = GPIO data
Set GPIO Data	715h	0ah	0000 0000h		a = GPIO data
Get GPIO Enable	F16h	00h	0000 000ah	0000 0000h (P,W)	a = GPIO enable
Set GPIO Enable	716h	0ah	0000 0000h		a = GPIO enable
Get GPIO Direction	F17h	00h	0000 000ah	0000 0000h (P,W)	a = GPIO direction
Set GPIO Direction	717h	0ah	0000 0000h		a = GPIO direction
Get GPIO Unsolicited Mask Enable	F19h	00h	0000 000ah	0000 0000h (P,W)	a = UnSol Enable
Set GPIO Unsolicited Mask Enable	719h	0ah	0000 0000h		a = UnSol Enable
Get GPIO Sticky Mask	F1Ah	00h	0000 000ah	0000 0000h (P,W)	a = GPIO sticky mask
Set GPIO Sticky Mask	71Ah	0ah	0000 0000h		a = GPIO sticky mask
Get Configuration Default	F1Ch F1Dh F1Eh F1Fh	00h	aabb ccddh	0000 0000h (P)	aa = Configuration 4 bb = Configuration 3 cc = Configuration 2 dd = Configuration 1 Response is the same to all Verb IDs
Set Configuration Default 1	71Ch	aah	0000 0000h		aa = Configuration 1

Table 22. Audio Function Group Node Parameters and Responses (3 of 3)

Description	Verb ID	Parameter	Response	Default Value	Comment
Set Configuration Default 2	71Dh	aah	0000 0000h		aa = Configuration 2
Set Configuration Default 3	71Eh	aah	0000 0000h		aa = Configuration 3
Set Configuration Default 4	71Fh	aah	0000 0000h		aa = Configuration 4
Get Subsystem ID	F20h F21h F22h F23h	00h	aaaa bbcch	14F1 0101h (P)	aaaa = Subsystem ID bb = SKU ID cc = Assembly ID Response is the same to all Verb IDs
Set Subsystem ID 1	720h	aah	0000 0000h		aa = Assembly ID
Set Subsystem ID 2	721h	aah	0000 0000h		aa = SKU ID
Set Subsystem ID 3	722h	aah	0000 0000h		aa = Subsystem ID low byte
Set Subsystem ID 4	723h	aah	0000 0000h		aa = Subsystem ID high byte
Function Reset	7FFh	00h	0000 0000h		Soft reset
GENERAL NOTES: The Configuration Default registers in the Audio Function Group Node are not normally used, but can be used to implement Secure Microphone function. Contact Conexant FAE/Sales to obtain additional information.					

3.2.3 Node ID 10, 11: DAC 1, DAC 2 Widget

Table 23 describes a stereo DAC that supports 16, 20, and 24 bit widths and 44.1, 48, 96, and 192 kHz sample rates.

Table 23. DAC 1, DAC2 Widget Parameters and Responses (1 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Converter Format	Ah	0000h	0000 aaaah	0000 0011h (P,W)	aaaa = Converter format
Set Converter Format	2h	aaaah	0000 0000h		aaaa = Converter format
Get Amplifier Gain/Mute	Bh	8000h A000h	0000 00aah 0000 00bbh	0000 003Ch (P,W)	aa = Right gain bb = Left gain Bit 7 is Mute setting
Set Amplifier Gain/Mute	3h	90aah A0bbh B0cch	0000 0000h		aa = Right gain bb = Left gain cc = Right and Left gain
Get Audio Widget Capabilities	F00h	09h	0000 0C1Dh		DAC—analogue
Get Supported PCM Size, Rates	F00h	0Ah	000E 0560h		16, 20, and 24 bit 44.1, 48, 96, and 192 kHz sample rate
Get Supported Stream Formats	F00h	0Bh	0000 0001h		PCM format is supported

Table 23. DAC 1, DAC2 Widget Parameters and Responses (2 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Output Amplifier Capabilities	F00h	12h	8003 4A4Ah		Mute capable, 1-dB steps, step 74 is 0 dB, 74 of 80 steps exposed
Get Power State	F05h	00h	0000 0abch	0000 0433h (P, W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state
Get Converter Stream, Channel	F06h	00h	0000 00abh	0000 0000h (P, R, V, W, D)	a = Stream b = Channel
Set Converter Stream, Channel	706h	abh	0000 0000h		a = Stream b = Channel
Get EAPD Enable	F0Ch	00h	0000 000ah	0000 0000h (P, W)	a = Left/right swap
Set EAPD Enable	70Ch	0ah	0000 0000h		a = Left/right swap

3.2.4 Node ID 12: S/PDIF Output Widget

Table 24 describes an S/PDIF DAC that supports 16, 20, and 24 bit widths, and 44.1, 48, and 96 kHz sample rates.

Table 24. S/PDIF Output Widgets Parameters and Responses

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Converter Format	Ah	0000h	0000 aaaah	0000 0011h (P, W)	aaaa = Converter format
Set Converter Format	2h	aaaah	0000 0000h		aaaa = Converter format
Get Audio Widget Capabilities	F00h	09h	0000 0611h		DAC—digital
Get Supported PCM Size, Rates	F00h	0Ah	000E 0160h		16, 20, and 24 bit widths 44.1, 48, and 96 kHz sample rates
Get Supported Stream Formats	F00h	0Bh	0000 0005h		PCM and AC-3 formats are supported
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Power State	F05h	00h	0000 0abch	0000 0433h (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state
Get Converter Stream, Channel	F06h	00h	0000 00abh	0000 0000h (P,R,V,W,D)	a = Stream b = Channel
Set Converter Stream, Channel	706h	abh	0000 0000h		a = Stream b = Channel
Get S/PDIF Converter Control	F0Dh F0Eh	00h	aabb ccddh	0000 0000h (P,W)	aa = Reserved bb = Coding mode cc = Category code dd = Header information
Set S/PDIF Converter Control 1	70Dh	aah	0000 0000h		aa = Header information
Set S/PDIF Converter Control 2	70Eh	aah	0000 0000h		aa = Category code
Set S/PDIF Converter Control 3	73Eh	aah	0000 0000h		aa = IEC coding type and Keep Alive Enable
Set S/PDIF Converter Control 4	73Fh	00h	0000 0000h		Reserved, read as 0

3.2.5 Node ID 13: PC Beep Generator Widget

Table 25 describes a beep generator. PC Beep is a mono signal, so writing either left, right, or both will set the single gain setting. Reading the left channel will return the current value; reading the right channel will return all zeros. Beep Generator widget's output is mixed in with all output ports.

NOTE: The two entries under Default for “Get Amplifier Gain/Mute” are because this is a mono widget. Only the left channel request is valid. Any request, read or write, having to do with only the right channel, should be ignored and will return 0000 0000h. If both left and right are present in the request only consider the value from the left side.

This PC Beep Generator Widget is unrelated to the Analog Beep pin. Refer to the Application Note describing the Analog Beep pin.

Table 25. Beep Generator Widget Parameters and Responses

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Amplifier Gain/Mute	Bh	8000h	0000 0000h	0000 0000h	00 = Right gain (NA)
		A000h	0000 00aah	0000 0002h (P,W)	aa = Left gain -24 dB
Set Amplifier Gain/Mute	3h	90aah	0000 0000h		aa = Right gain (NA)
		A0aah			aa = Left gain
		B0aah			aa = Left gain
Get Audio Widget Capabilities	F00h	09h	0070 000Ch		PC Beep Generator with output amplifier
Get PC Beep Output Amplifier Capabilities	F00h	12h	000F 0707h		4 dB steps, 8 steps, step 8 is -4 dB
Get Beep Generation	F0Ah	00h	0000 00aah	0000 0000h (P,W)	aa = Divider
Set Beep Generation	70Ah	aah	0000 0000h		aa = Divider
GENERAL NOTES: When the codec is in RESET the PC BEEP gain is -46 dB. A pull-down on SPDIF pin for -21Z devices only will set the gain to -18 dB while the codec is in RESET.					

3.2.6 Node ID 14, 15, and 16: ADC1, ADC2, and ADC3 Widgets

Table 26 describes a stereo ADC that supports 16-, 20-, and 24-bit widths and 44.1, 48, and 96 kHz sample rates. The ADC has a gain stage and a stereo one-of-four input selector.

Table 26. ADC Widget Parameters and Responses (1 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Converter Format	Ah	0000h	0000 aaaah	0000 0011h (P,W)	aaaa = Converter format
Set Converter Format	2h	aaaah	0000 0000h		aaaa = Converter format
Get Amplifier Gain/Mute	Bh	000ah 200ah	0000 00bbh 0000 00bbh	0000 004Ah (P,W)	bb = Right amp gain/mute bb = Left amp gain/mute a = Input index (0, 1, 2, 3, or 4)
Set Amplifier Gain/Mute	3h	5abbh 6abbh 7abbh	0000 0000h		bb = Right gain/mute bb = Left gain/mute bb = Right & Left gain/mute a = Input index (0, 1, 2, 3, or 4)
Get Audio Widget Capabilities	F00h	09h	0010 0D1Bh		Audio input, analog
Get Supported PCM Size, Rates	F00h	0Ah	000E 0160h		16, 20, and 24 bits 44.1, 48, and 96 kHz
Get Supported Stream Formats	F00h	0Bh	0000 0001h		PCM only
Get Input Amplifier Capabilities	F00h	0Dh	8003 504Ah		Mute, 1-dB steps, 80 steps, step 74 is 0 dB
Get Connection List Length	F00h	0Eh	0000 0004h		Connected to 4 widgets
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Connection Select	F01h	00h	0000 000ah	0000 0000h (P,W)	a = Connection Index
Set Connection Select	701h	0ah	0000 0000h		a = Connection Index
Get Connection List Entry	F02h	00h	2423 1817h		Four connections
Get Connection List Entry	F02h	04h	0000 0000h		Four connections

Table 26. ADC Widget Parameters and Responses (2 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Power State	F05h	00h	0000 0abch	0000 0433h (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state
Get Converter Stream/Channel	F06h	00h	0000 00abh	0000 0000h (P,R,V,W,D)	a = Stream b = Channel position
Set Converter Stream/Channel	706h	abh	0000 0000h		a = Stream b = Channel position
Get EAPD/BTL	F0Ch	00h	0000 000a	0000 0000h (P,W)	a = Left/right swap
Set EAPD/BTL	70Ch	0ah	0000 0000h		a = Left/right swap

3.2.7 Node ID 17 and 18: Selector Widgets

Table 27. Selector Widgets Parameters and Responses

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Amplifier Gain/Mute	Bh	8000h A000h	0000 000ah 0000 000ah	0000 0000h (P,W)	a = Right gain a = Left gain
Set Amplifier Gain/Mute	3h	900ah A00ah B00ah	0000 0000h		a = Right gain a = Left gain a = Right/Left gain
Get Audio Widget Capabilities	F00h	09h	0030 050Dh		Selector with output amplifier
Get Selector Output Amplifier Capabilities	F00h	12h	0027 0400h		10-dB steps, 5 steps, step 0 is 0 dB
Get Connection List Length	F00h	0Eh	0000 0004h		Connected to 4 widgets
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Connection Select	F01h	00h	0000 000ah	0000 0000h (P,W)	Port B selected
Set Connection Select	701h	0ah	0000 0000h		0 = Port B 1 = Port C 2 = Port E 3 = Port F
Get Connection List Entry	F02h	00h	1E1D 1B1Ah		Connected to Ports B, C, E, and F
Get Power State	F05h	00h	0000 0abch	0000 0433 (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state

3.2.8 Node ID 19: Port A Pin Widget

Table 28 describes a Pin Widget that has a gain stage. The Port A Pin Widget has selectable headphone or line drive and supports jack sensing.

Table 28. Port A Pin Widget Parameters and Responses (1 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Audio Widget Capabilities	F00h	09h	0040 0581		Pin Widget – Analog
Get Pin Capabilities	F00h	0Ch	0000 001Ch		Output, HP, sense (Port A)
Get Connection List Length	F00h	0Eh	0000 0002h		Connected to 2 widgets
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Connection Select	F01h	00h	0000 000ah	0000 0000h (P,W)	DAC1 selected
Set Connection Select	701h	0ah	0000 0000h		0 = DAC1 1 = DAC2
Get Connection List Entry	F02h	00h	0000 1110h		DAC1, DAC2
Get Power State	F05h	00h	0000 0abch	0000 0433 (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state
Get Pin Widget Control	F07h	00h	0000 00a0h	0000 0000h (P,W)	a = Headphone and output enable
Set Pin Widget Control	707h	a0h	0000 0000h		a = Headphone and output enable
Get Unsolicited Response	F08h	00h	0000 00aah	0000 0000h (P,W)	aa = Unsolicited enable and tag
Set Unsolicited Response	708h	aah	0000 0000h		aa = Unsolicited enable and tag
Get Pin Sense	F09h	00h	aFFF FFFF		a = Presence detect (bit 31) F = present, 7 = missing

Table 28. Port A Pin Widget Parameters and Responses (2 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Configuration Default	F1Ch F1Dh F1Eh F1Fh	00h	aabb cddh	Node 19: 0421 401Fh (P)	aa = Configuration 4 bb = Configuration 3 cc = Configuration 2 dd = Configuration 1 Response is the same to all Verb IDs
Set Configuration Default 1	71Ch	aah	0000 0000h		aa = Configuration 1
Set Configuration Default 2	71Dh	aah	0000 0000h		aa = Configuration 2
Set Configuration Default 3	71Eh	aah	0000 0000h		aa = Configuration 3
Set Configuration Default 4	71Fh	aah	0000 0000h		aa = Configuration 4

3.2.9 Node ID 1A: Port B Widget

Table 29 describes a stereo input Pin Widget that can be configured to be a line input or microphone input. There is a microphone boost control and microphone bias. This Pin Widget supports jack sensing.

Table 29. Port B Pin Widget Parameters and Responses (1 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Audio Widget Capabilities	F00h	09h	0040 0481h		Pin Widget – Analog
Get Pin Capabilities	F00h	0Ch	0000 1324h		Vref, input, jack sense
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Power State	F05h	00h	0000 0abch	0000 0433 (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state
Get Pin Widget Control	F07h	00h	0000 00aah	0000 0000h (P,W)	a = Vref, input enable
Set Pin Widget Control	707h	aah	0000 0000h		a = Vref, input enable
Get Unsolicited Response	F08h	00h	0000 00aah	0000 0000h (P,W)	aa = Unsolicited enable and tag

Table 29. Port B Pin Widget Parameters and Responses (2 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Set Unsolicited Response	708h	aah	0000 0000h		aa = Unsolicited enable and tag
Get Pin Sense	F09h	00h	aFFF FFFF		a = Presence detect (bit 31) F = present, 7 = missing
Get Configuration Default	F1Ch F1Dh F1Eh F1Fh	00h	aabb ccddh	04A1 902Eh (P)	aa = Configuration 4 bb = Configuration 3 cc = Configuration 2 dd = Configuration 1 Response is the same to all Verb IDs
Set Configuration Default 1	71Ch	aah	0000 0000h		aa = Configuration 1
Set Configuration Default 2	71Dh	aah	0000 0000h		aa = Configuration 2
Set Configuration Default 3	71Eh	aah	0000 0000h		aa = Configuration 3
Set Configuration Default 4	71Fh	aah	0000 0000h		aa = Configuration 4

3.2.10 Node ID 1B: Port C Widget

Table 30 describes a stereo input Pin Widget that can be configured to be a line input, microphone input, or line output. There is a microphone boost control and microphone bias. This Pin Widget supports jack sensing.

NOTE: The EAPD pin is shared with GPIO_0. In order for the EAPD to be active, GPIO_0 must have its enable bit set to 0, which disables GPIO_0.

Table 30. Port C Pin Widget Parameters and Responses (1 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Audio Widget Capabilities	F00h	09h	0040 0581h		Pin Widget – Analog
Get Pin Capabilities	F00h	0Ch	0001 1334h		EAPD, Vref, input, output, jack sense
Get Connection List Length	F00h	0Eh	0000 0002h		Connected to 2 widgets
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Connection Select	F01h	00h	0000 000ah	0000 0000h (P,W)	DAC1 selected
Set Connection Select	701h	0ah	0000 0000h		0 = DAC1 1 = DAC2
Get Connection List Entry	F02h	00h	0000 1110h		DAC1, DAC2
Get Power State	F05h	00h	0000 0abch	0000 0433 (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state
Get Pin Widget Control	F07h	00h	0000 00aah	0000 0000h (P,W)	aa = Vref, input, output enable
Set Pin Widget Control	707h	aah	0000 0000h		aa = Vref, input, output enable
Get Unsolicited Response	F08h	00h	0000 00aah	0000 0000h (P,W)	aa = Unsolicited enable and tag
Set Unsolicited Response	708h	aah	0000 0000h		aa = Unsolicited enable and tag
Get Pin Sense	F09h	00h	aFFF FFFF		a = Presence detect (bit 31) F = present, 7 = missing

Table 30. Port C Pin Widget Parameters and Responses (2 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get EAPD/BTL	F0Ch	00h	0000 000ah	0000 0000h (P,W)	a = EAPD
Set EAPD/BTL	70Ch	0ah	0000 0000h		a = EAPD
Get Configuration Default	F1Ch F1Dh F1Eh F1Fh	00h	aabb ccddh	21A1 90F0h (P)	aa = Configuration 4 bb = Configuration 3 cc = Configuration 2 dd = Configuration 1 Response is the same to all Verb IDs
Set Configuration Default 1	71Ch	aah	0000 0000h		aa = Configuration 1
Set Configuration Default 2	71Dh	aah	0000 0000h		aa = Configuration 2
Set Configuration Default 3	71Eh	aah	0000 0000h		aa = Configuration 3
Set Configuration Default 4	71Fh	aah	0000 0000h		aa = Configuration 4

3.2.11 Node ID 20: Port H, S/PDIF Digital Pin Widget

The following table describes a digital output Pin Widget with jack sense.

NOTE:

The two entries in “Get Pin Capabilities” are controlled by an HDMI enable bit in the Vendor Test Node (25). Power-on reset will default the HDMI bit to be off (top entry). Writing a 1 to the test bit will add the HDMI indication to the pin capabilities.

Setting the Pin Widget output enable to 0 (disable output) should act as if the S/PDIF Vcfg bit was set to 0 and the V bit set to 1. This “mutes” the transmitter by marking all the data as invalid. But the S/PDIF clock, header, and data must still be sent. Setting the Pin Widget output enable to 1 allows the transmitter to behave as requested by the V and Vcfg bits.

Table 31. S/PDIF Pin Widgets Parameters and Responses (1 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Audio Widget Capabilities	F00h	09h	0040 0781h		Pin Widget – Digital with jack sense
Get Pin Capabilities	F00h	0Ch	0000 0014h		Both nodes are output only
Get Connection List Length	F00h	0Eh	0000 0001h		Connected to 1 widget
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Connection List Entry	F02h	00h	0000 0012h 0000 0021h		S/PDIF1 S/PDIF2
Get Power State	F05h	00h	0000 0abch	0000 0433 (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state
Get Pin Widget Control	F07h	00h	0000 00a0h	0000 0000h (P,W)	a = Output enable
Set Pin Widget Control	707h	a0h	0000 0000h		a = Output enable
Get Unsolicited Response	F08h	00h	0000 00aah	0000 0000h (P,W)	aa = Unsolicited enable and tag
Set Unsolicited Response	708h	aah	0000 0000h		aa = Unsolicited enable and tag

Table 31. S/PDIF Pin Widgets Parameters and Responses (2 of 2)

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Pin Sense	F09h	00h	aFFF FFFF		a = Presence detect (bit 31) F = present, 7 = missing
Get Configuration Default	F1Ch F1Dh F1Eh F1Fh	00h	aabb ccddh	Node 20: 0445 71F0h (P)	aa = Configuration 4 bb = Configuration 3 cc = Configuration 2 dd = Configuration 1 Response is the same to all Verb ID's
Set Configuration Default 1	71Ch	aah	0000 0000h		aa = Configuration 1
Set Configuration Default 2	71Dh	aah	0000 0000h		aa = Configuration 2
Set Configuration Default 3	71Eh	aah	0000 0000h		aa = Configuration 3
Set Configuration Default 4	71Fh	aah	0000 0000h		aa = Configuration 4

3.2.12 Node ID 23: Port J Digital Microphone Widget

Table 32 describes a stereo microphone Pin Widget.

Table 32. Port J Pin Widget Parameters and Responses

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Amplifier Gain/Mute	Bh	0000h 2000h	0000 00aah 0000 00aah	0000 0000h (P,W)	aa = Right gain aa = Left gain
Set Amplifier Gain/Mute	3h	50aah 60aah 70aah	0000 0000h		aa = Right gain aa = Left gain aa = Right/Left gain
Get Audio Widget Capabilities	F00h	09h	0040 040Bh		Pin Widget – Analog
Get Pin Capabilities	F00h	0Ch	0000 0020h		Input only
Get Input Amplifier Capabilities	F00h	0Dh	002F 0400h		12-dB steps, 5 steps, step 0 is 0 dB
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Power State	F05h	00h	0000 0abch	0000 0433 (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state
Get Pin Widget Control	F07h	00h	0000 00a0h	0000 0000h (P,W)	a = Input enable
Set Pin Widget Control	707h	a0h	0000 0000h		a = Input enable
Get Configuration Default	F1Ch F1Dh F1Eh F1Fh	00h	aabb ccddh	90A7 00F0h (P)	aa = Configuration 4 bb = Configuration 3 cc = Configuration 2 dd = Configuration 1 Response is the same to all Verb IDs
Set Configuration Default 1	71Ch	aah	0000 0000h		aa = Configuration 1
Set Configuration Default 2	71Dh	aah	0000 0000h		aa = Configuration 2
Set Configuration Default 3	71Eh	aah	0000 0000h		aa = Configuration 3
Set Configuration Default 4	71Fh	aah	0000 0000h		aa = Configuration 4

3.2.13 Node ID 1F: Port G Widget

Table 33 describes a Pin Widget that is a dedicated stereo speaker driver.

Table 33. Port G Pin Widget Parameters and Responses

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Audio Widget Capabilities	F00h	09h	0040 0501h		Pin Widget – Analog
Get Pin Capabilities	F00h	0Ch	0000 0010h		Output only
Get Connection List Length	F00h	0Eh	0000 0002h		Connected to 2 widgets
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Connection Select	F01h	00h	0000 000ah	0000 0000h (P,W)	DAC1 selected
Set Connection Select	701h	0ah	0000 0000h		0 = DAC1 1 = DAC2
Get Connection List Entry	F02h	00h	0000 1110h		Connected to DAC1, DAC2
Get Power State	F05h	00h	0000 0abch	0000 0433 (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state
Get Pin Widget Control	F07h	00h	0000 00a0h	0000 0040h (P,W)	a = Output enable
Set Pin Widget Control	707h	a0h	0000 0000h		a = Output enable
Get Configuration Default	F1Ch F1Dh F1Eh F1Fh	00h	aabb ccddh	9017 0010h (P)	aa = Configuration 4 bb = Configuration 3 cc = Configuration 2 dd = Configuration 1 Response is the same to all Verb IDs
Set Configuration Default 1	71Ch	aah	0000 0000h		aa = Configuration 1
Set Configuration Default 2	71Dh	aah	0000 0000h		aa = Configuration 2
Set Configuration Default 3	71Eh	aah	0000 0000h		aa = Configuration 3
Set Configuration Default 4	71Fh	aah	0000 0000h		aa = Configuration 4

3.2.14 Node ID 24: Mixer Widget

Table 34 describes a Mixer (Summing) Widget.

Table 34. Mixer Widget Parameters and Responses

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Amplifier Gain/Mute	Bh	000ah 200ah	0000 00bbh 0000 00bbh	0000 0000h (P,W)	bb = Right amp gain/mute bb = Left amp gain/mute a = Input index (0, 1, or 2)
Set Amplifier Gain/Mute	3h	5abbh 6abbh 7abbh	0000 0000h		bb = Right gain/mute bb = Left gain/mute bb = Right & Left gain/ mute a = Input index (0, 1, or 2)
Get Audio Widget Capabilities	F00h	09h	0020 050Bh		Mixer with input amplifier
Get Input Amplifier Capabilities	F00h	0Dh	8003 4A4Ah		Mute, 1-dB steps, 74 steps, step 74 is 0 dB
Get Connection List Length	F00h	0Eh	0000 0002h		Connected to 2 widgets
Get Supported Power States	F00h	0Fh	8000 001Fh 0000 001Fh		EPSS, D0, D1, D2, D3 and D4 Bold is with EPSS supported (default for -21Z)
Get Connection List Entry	F02h	00h	0000 1110h		Connected to DAC1, DAC2
Get Power State	F05h	00h	0000 0abch	0000 0433 (P,W)	a = Settings reset b = Actual state c = Requested state Settings reset cleared by this verb or any write to this node
Set Power State	705h	0ah	0000 0000h		a = Requested state

3.2.15 Node ID 25, 27: Vendor (Device Test) Widgets

Table 35 describes a Vendor Widget. This node is used for software support and device testing. Contact Conexant FAE/Sales to get additional documentation describing the contents and usage of the registers contained here.

Table 35. Vendor (Device Test) Widget Parameters and Responses

Description	Verb ID	Parameter	Response	Default Value	Comment
Get Timer	900h	00h	0000 00aah	0000 0000h (P,W)	aa = Bus timer value
Get Timer	100h	aah	0000 0000h		aa = Bus timer value
Get Test Codec	Ah	a000h	0000 0bbbh	0000 0000h (P)	a = Register number bbb = 12-bit value
Set Test Codec	2h	abbbh	0000 0000h		a = Register number bbb = 12-bit value
Get Test Analog	Bh	a000h	0000 0bbbh	0000 0000h (P)	a = Register number bbb = 12-bit value
Set Test Analog	3h	abbbh	0000 0000h		a = Register number bbb = 12-bit value
Get Test Digital	Ch	a000h	0000 0bbbh	0000 0000h (P)	a = Register number bbb = 12-bit value
Set Test Digital	4h	abbbh	0000 0000h		a = Register number bbb = 12-bit value
Get Audio Widget Capabilities	F00h	09h	00F0 0000h		Type is vendor-defined widget

3.3 Unsolicited Messages

3.3.1 Audio Unsolicited Messages

Table 37 describes all possible bit coding and sources of unsolicited messages for the audio function group. The “Tag” comes from the unsolicited message tag stored in the node that generated the event.

Table 36. Audio Unsolicited Messages Tag Fields

[31:26]	[25:4]	[3:0]
Tag	Res	data

Table 37. Audio Unsolicited Messages Bit Coding and Sources

Tag ID	Data:3	Data:2	Data:1	Data:0	Description
Node 1	Bus Timer	—	GPIO 1 change	GPIO 0 change	
Node 19	0	0	0	Jack change	0 = jack removed 1 = jack inserted
Node 1A	0	0	0	Jack change	0 = jack removed 1 = jack inserted
Node 1B	0	0	0	Jack change	0 = jack removed 1 = jack inserted

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